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## MONOGRAPH OF THE CORYNELIACEAE

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(*Continued from the July number*)

4. CORYNELIA Fries ex. Acharius, Systema Mycologicum 2: 535. 1822

*Corynelia* Acharius, in Fries Obs. Mycol. 2: 343. 1818.

Type species. *Corynelia uberata* Fries ex Acharius.

Stromata black, formed within the host tissue, later erumpent, usually small and scattered, in *C. fructicola* confluent to form an effuse crust, bearing perithecia and in some species also pycnidia, perithecia seated on the stroma, cespitose, elongated (flask-shaped, barrel-shaped, top-shaped, clavate, etc.) the apex rounded and undifferentiated, or definitely lobed, in *C. fructicola* flattened into a disc as in *Tripospora;* not provided with a typical ostiolum, at maturity dehiscent either by a wide opening resulting from one or more deep clefts, or as in *C. fructicola,* fimbriate-lacerate at the apex and finally dehiscent by a wide funnel-shaped opening; asci ovate to clavate, long-stalked, thin-walled, evanescent, usually 8-spored (varying from 1–8), aparaphysate; ascospores when young hyaline, smooth and by mutual pressure polyhedral; at maturity, spherical, brown, thick-walled, echinulate, unicellular; pycnidia seated on the stroma among the perithecia, more or less globose, black; pycnospores hyaline, elongated to fusiform, unicellular.

In this genus the ascospore is provided with a thin, echinulate epispore and a thick endospore. On young spores the echinulations are slightly developed or absent. The endospore at maturity is provided with a considerable number of definite circular thin-spots or perforations which are probably germ-pores. These

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apparently vary in number but in some cases certainly exceed fifteen.

KEY TO THE SPECIES OF CORYNELIA

*A.* Perithecium with a definite cylindrical neck broadened at the apex into a flattened disc; dehiscence by fimbriate-laceration, no definite cleft formed.

1. Asci 8-spored; stromata confluent to form an effuse crust; species on Rapanea (Myrsine).

1. *C. fructicola* (Figures 20, 21).

2. Asci 2-spored; stromata scattered; species on Podocarpus.

2. *C. bispora*[9] (Figure 43).

*B.* Perithecial neck lacking or if present then not broadened at the apex into a flattened disc; dehiscence by one or more definite clefts; all species on Podocarpus.

1. Apex of unopened perithecium not definitely lobed.

*a.* Perithecium barrel-shaped, more or less roughened and wrinkled, the apex flattened and the sides longitudinally grooved.

3. *C. tropica* (Figures 26–29).

*b.* Perithecium at maturity more or less dumb-bell shaped and frequently inequilateral, with a constricted middle portion, and a terminal swelling which is usually shaggy and traversed by several transverse parallel grooves.

4. *C. uberata* (Figures 13–18).

*c.* Perithecium top-shaped, the broadly rounded apex traversed by a single prominent shallow furrow.

5. *C. nipponensis*[10] (Figure 19).

*d.* Perithecium wedge-shaped at the apex, short-cylindrical below, dehiscence occurring along the sharp edge.

7. *C. brasiliensis* (Figures 4, 5).

2. Apex of unopened perithecium definitely lobed.

*a.* Apex typically 3-lobed, rarely 2- or 4-lobed, asci typically 8-spored.

6. *C. oreophila* (Figures 8–12, 39, 40).

*b.* Apex typically 2-lobed, in some individuals 3-lobed, asci typically 3-spored.

8. *C. portoricensis* (Figures 1–3, 41, 42).

*c.* Apex typically 3-lobed, in some individuals 4–5-lobed, asci typically 3-spored.

9. *C. jamaicensis* (Figures 6, 7).

1. CORYNELIA FRUCTICOLA (Patouillard) v. Höhnel, Sitzber. Kais. Akad. Wiss. Wien. **120**: 450. 1911

*Capnodium fructicolum* Patouillard, Journal de Botanique **3**: 258, 259. 1889.

[9] Dehiscent perithecia not yet seen, but dehiscence probably as in *C. fructicola*.

[10] Dehiscent perithecia not yet seen, but dehiscence by a single apical cleft is probable.

*Corynelia carpophila* Sydow, Botanische Jahrbucher von Engler **45**: 264. 1910.

TYPE: in herbarium of Patouillard; portion of this communicated by Patouillard deposited as No. 1642 in herbarium of the writer.

(Figures 20, 21)

Stromata fructicolous, pulvinate, black; usually rounded, often laterally confluent to form an extensive, effuse, black crust which partially or completely envelopes the fruit; individual stromata 1 mm. or less in diameter, covered by a crowded cluster of perithecia frequently showing many stages of development on a single stroma; perithecium resembling closely that of *Tripospora tripos*, definitely flask-shaped, with a spherical to ovoidal, ascigerous, basal portion and a long, narrow cylindrical neck, rounded and blunt at the apex; the neck of the perithecium provided with a canal and in early stages marked at the apex with a minute umbilicus, but closed; in later stages the apex broadened to form a wide, slightly convex disc the diameter of which equals or exceeds that of the basal, ascigerous portion; this disc becoming fimbriate-lacerate, and assuming a reddish-brown, fuzzy appearance, finally dehiscent, the margin recurving, forming a funnel-shaped opening and exposing the lighter colored inner wall; asci 11–14 × 20–25 μ (p. sp.), 8-spored; ascospores 6.5–10.5 μ in diam.; pycnidia present; pycnospores elongated to allantoid, hyaline, 4–6 × 1 μ.

Parasitic on *Myrsine africana* in India, on *Myrsine* sp. in China, and on *Rapanea melanophloeos* in South Africa. Not known on other hosts or from other localities.

The genera *Rapanea* and *Myrsine* are very closely related, being treated side by side in Das Pflanzenreich of Engler. In Engler und Prantl, Die Natürliche Pflanzenfamilien, the genus *Myrsine* is alone recognized, *Rapanea* being cited as a synonym.

Patouillard (**34**) described *Capnodium fructicolum* upon material collected by Delavay in China on a species of *Myrsine*. Later Sydow (**51**) described *Corynelia carpophila* upon material collected by Lane Poole in South Africa on Rapanea. Von Höhnel (**22**) saw material collected in India by Butler and from it concluded that *Capnodium fructicolum* is a species of *Corynelia* and probably identical with *Corynelia carpophila*. The writer

has compared the type material of *Capnodium fructicolum* with material of the original collection of *Corynelia carpophila* Sydow and with other South African material and has found them to be the same. He has also seen a portion of the material from India collected by Butler (**52**).

MATERIAL EXAMINED

Transvaal, S. Africa: Union Department of Agriculture, Mycological Herbarium No. 1736 (collected at Helpmakaar, Zoutpansberg, Aug. 5, 1911, identified by Sydow, communicated by Miss Ethel M. Doidge, and deposited as Fitzpatrick Herb. No. 1503); Fitzpatrick Herb. No. 1748 (portion of original collection of *Corynelia carpophila* Sydow, obtained through the kindness of L. Romell from the herbarium at Dahlem).

Cape Province, S. Africa: Union Department of Agriculture, Mycological Herbarium No. 7795 (collected at Kentani, June 3, 1914, by A. Pegler, communicated by Miss Ethel M. Doidge, and deposited as Fitzpatrick Herb. No. 1620; material also deposited at Harvard University, New York Botanical Garden and in Plant Pathology herbarium at Cornell University).

Southwest China, Province of Yun-nan: Herbarium of Patouillard (*type* collected by Delavay; communicated by Patouillard).

East India, Mussoorie: Herbarium Crypt. Ind. Orient on *Myrsine africana* (collected and communicated by E. J. Butler; deposited as Fitzpatrick Herb. No. 1643).

2. **Corynelia bispora** sp. nov.

*Corynelia clavata f. macrospora* Sydow, Deutsche Zentral-Afrika-Exped. 1907–1908 Unter Führnug Adolf Friedrichs **2**: 100. 1910.

TYPE: original collection of *C. clavata f. macrospora* Sydow in herbarium of Sydow at Königl. Botanischer Garten und Museum at Berlin-Dahlem, Germany. Slides showing asci, mature ascospores, and pycnospores taken from a portion of the original material are deposited as No. 1722 in the writer's herbarium.

(Figure 43)

Stromata scattered, small, hypophyllous; perithecia narrowly flask-shaped, the neck dilated at the apex to form a flattened tip resembling somewhat that of *C. fructicola,* but considerably narrower and consequently less prominent than in that species; method of dehiscence undetermined but probably by fimbriate-laceration as indicated by the slightly fuzzy appearance of the apex of the perithecium; asci $60 \times 17$–$20\,\mu$ (p. sp.), 2-spored; spores 11–15 $\mu$ in diam., pycnidia present; pycnospores hyaline, yellowish in mass, fusiform, $5$–$8 \times 2\,\mu$.

Parasitic on *Podocarpus milanjiani* in central Africa. Known only from the original collection, and from the type locality near Ruwenzori.

The species is founded upon a fragmentary bit of the type material of *Corynelia clavata f. macrospora* Sydow. Only a single mature perithecium was obtained for study, but this was sufficient to show that the fungus is very unlike *C. clavata* (*C. uberata*) and cannot be regarded as a variety of that species. It is probable that a critical examination of the remainder of the original collection at Berlin would make possible a more complete description of the fungus, particularly with reference to the method of dehiscence of the perithecium.

Sydow (**50**) states that *Corynelia clavata f. macrospora* differs from the type species in its larger spores, $10$–$17 \times 10$–$14\,\mu$, but agrees in all of its other characters. He states further that the spores of the type never exceed 9–11 $\mu$. The writer's observations differ from those of Sydow in several essential points. In *C. clavata* measurements of spores from a number of collections show that mature spores average 12 $\mu$ in diameter and frequently reach 14 $\mu$, thus considerably exceeding the limit set by Sydow. In *C. clavata f. macrospora* the spores measure 11–15 $\mu$ in the fragment examined but fail to reach the maximum diameter of 17 $\mu$ given by Sydow. The 2-spored asci serve to distinguish the fungus from *C. clavata;* moreover the appearance of the perithecium in the two forms is not the same. Several dozen 2-spored asci may be clearly seen in the slide deposited in the writer's herbarium and no variation from the 2-spored condition has been observed.

3. CORYNELIA TROPICA (Auerswald & Rabenhorst) Starbäck, Arkiv. for Botanik **5**: 18–20, *pl. 1, fig. 14.* 1905

*Endohormidium tropicum* Auerswald & Rabenhorst, Hedw. **8**: 89. 1869. (Rabenhorst Fungi europaei No. 1261 distributed in 1869, bears the same description, and contains a figure drawn by Fleischhak.)

*Trullula tropica* (Auerswald & Rabenhorst) Saccardo, Sylloge Fungorum **3**: 732. 1884.

*Corynelia clavata* (Linnaeus) Saccardo f. *andina* P. Hennings, Hedw. **36**: 230. 1897.

*Corynelia clavata* (Linnaeus) Saccardo p.p., in Rehm, Hedw. **37**: 328. 1898; Hennings, Hedw. **39**: 76. 1900; Saccardo, Sylloge Fungorum **16**: 650. 1902.

ILLUSTRATIONS: Fleischhak in Rab. Fung. Europ. 1261. Starbäck, Arkiv för Botanik **5**: *pl. 1, fig. 14.*

TYPE: Rabenhorst Fungi Europaei No. 1261. Material of this collection showing both asci and spores seen by the writer. (Prepared slide No. 1212a in Fitzpatrick herbarium shows asci and spores.)

(Figures 26–29)

Stromata amphigenous (chiefly hypophyllous) and caulicolous, not reported as fructicolous, usually irregular in outline, not characteristically circular, frequently much elongated, especially when erumpent along the midrib or along the edge of the leaf, occasionally elongated at right angles to the long axis of the leaf, 1–2 × 1–7 mm., dull black, rough, in section dark brown, bearing 10–50 or more crowded perithecia; perithecia erumpent, irregularly arranged on the stroma and less uniform in appearance than those of other species of the genus; immature perithecia globose or irregular due to crowding, later becoming characteristically barrel-shaped, the upper end more or less flattened and the sides marked with 6–8 parallel longitudinal grooves, the whole surface irregularly roughened by warts and wrinkles, dull black to brownish black, 0.5–1.0 mm. in length, slightly less than 0.5 mm. in width, carbonaceous; the apex of the mature perithecium marked by a faint transverse line along which dehiscence occurs, dehiscent by a wide and deep split, the two lips pulling apart and exposing the brownish-red interior of the perithecium; the margins of the lips tending to become fimbriate-lacerate and giv-

ing the fuzzy appearance seen in *C. fructicola;* asci 17–25 × 25–37 μ (p. sp.), 8-spored (rarely a 4-spored ascus or one in which some of the spores are imperfectly formed found); spores 9–12.5 μ (mostly 11 μ) in diameter.

Parasitic on *Podocarpus saligna, P. chilina* and *P. andina* in Chili, and on *P. costata* in the Philippine Islands. Not reported from other regions.

The specimens from the Philippine Islands included here contain in most cases only immature perithecia. Asci and mature spores have been observed in one collection, and are indistinguishable from those of South America material of *C. tropica.* The examination of additional Philippine material is desirable, especially since dehiscent perithecia have been observed only in the South American material. Although the fungus from the Philippines seems to differ in certain minor respects from South American specimens of *C. tropica* it certainly agrees more closely with this species than with any other as yet described, and in the present state of our knowledge the erection of a new species seems unwarranted. Rehm (**44**) Baker (**3, 4**), and others are clearly in error in regarding the Philippine fungus as *C. uberata.*

Auerswald and Rabenhorst (**2**) who first described *C. tropica* under the name *Endohormidium tropicum* state in their description of the species that the perithecium lacks an ostiolum. Had they found asci they doubtless would have placed the fungus in the Perisporiaceae. Neither Hennings (**18, 20**) nor Starbäck (**48**), who later studied the species, say anything concerning the dehiscence of the perithecium. Since they place the species in the Coryneliaceae, they may, however, be assumed to have believed that an ostiolum is present. Material of this species showing the method of dehiscence has been seen by the writer in only three specimens.[11] It may be safely assumed that these earlier writers never saw dehiscent perithecia. The appearance of the young perithecium gives no indication of an apical split, and the line of dehiscence seen on mature perithecia is not prominent.

Léveillé (**27**) describes *Sphaeronema clavatum* from material

[11] No. 1261 Rabenhorst, Fungi europaei in Herb. Rehm at Stockholm, Sweden, and No. 4261 Rabenhorst-Pazschke, Fungi europaei et extra-europaei at Purdue Univ., and at Harvard Univ.

on *Drymis chilensis* DC. collected by Gay in Chili and deposited in the herbarium of the Museum of Paris. Jaczewski (**24**) in connection with the preparation of his monograph of Sphaeronema reëxamined this specimen and found two fungi present. One of these, a pycnidial form, he recognized as *Sphaeronema clavatum* Lév., but transfers it to *Aposphaeria* under the name *A. clavatum* Jaczewski. The other a perithecial form which had meanwhile been incorrectly labeled in the herbarium *Corynelia clavata* Montagne, he refers to the genus *Caliciopsis* Peck. His description of the fungus is extremely interesting in several respects. He states that a section through the perithecium reveals a distinct stalk and an ovoid receptacle which is at first closed but later opens *by a large cleft at the tip*. He also states that the asci are long-stalked, ovoid, surrounded by paraphyses and contain 8 globose, brown, 1-celled spores, 7.5 $\mu$ in diameter. He publishes also figures showing a perithecium and an ascus. There is little doubt that this material represents a species of the Coryneliaceae and the description of the method of dehiscence by a wide cleft is the only one recorded in literature for any species of the group. There is also reason to believe that this material was in reality *C. tropica*. In the phanerogamic herbarium at Harvard University there is a specimen of *Podocarpus chilina* collected by Gay in Chili and sent to Harvard from the herbarium of the Museum of Paris. This specimen bears no number or other identifying label. On the leaves of this specimen the writer has found perithecia of *C. tropica*. Since the specimen in the herbarium at Paris which was examined by Jaczewski was also collected in Chili by Gay and since no species of *Corynelia* has been found on *Drymis* there is reason to suspect that this specimen was in reality *Podocarpus* and perhaps identical with the Harvard material. The host genera are not closely related but their leaves could be confused in poor specimens.

### MATERIAL EXAMINED

Chili: Rabenhorst, Fungi europaei No. 1261 (*type* material: at N. Y. Bot. Gard., in Herb. H. Rehm, Stockholm, Sweden, and in Plant Path. herb. at Cornell Univ.); Rabenhorst-Pazschke,

Fungi europaei et extraeuropaei No. 4261 (in Bot. Dept. herb. at Harvard Univ., in Bot. Dept. herb. in Indiana Agric. Exp. Sta., Purdue University, in herb. H. Rehm, Stockholm, Sweden, and in U. S. Dept. Agric. Plant Industry herb.); Rehm, Ascomyceten No. 1326b (herb. H. Rehm, Stockholm, Sweden, and herb. C. E. Fairman, Lyndonville, N. Y.; the two specimens in Bot. Dept. herb. at Harvard Univ. are *C. oreophila*); Fitppatrick Herb. No. 1569 (material found in phanerogamic herbarium at Upsula, Sweden, on leaves of *Podocarpus chilina* distributed as No. 467 W. Lechler Pl. Chilenses Ed. R. F. Hokenacker; communicated by O. Juel); Fitzpatrick Herb. Nos. 1485, 1486, and 1487 (material found in phanerogamic herbarium at Harvard Univ. on leaves of *P. chilina* collected by H. Alabar, K. Ocksenius, and C. Gay respectively; communicated by A. J. Eames); Fitzpatrick Herb. No. 1374 (material found in phanerogamic herbarium at N. Y. Bot. Gard. on leaves of *P. chilina*, obtained in exchange from Herb. Mus. Paris); Fitzpatrick Herb. No. 1193 (material found in phanerogamic herbarium at N. Y. Bot. Gard. on leaves of *P. saligna* collected by Philippi).

Philippine Islands: Baker, Fungi Malayana No. 130 (in U. S. Dept. Agr. Bur. Pl. Industry Herb.; in Herb. Bur. Sci. Philippine Islands, Manila; and at Harvard Univ.); Nos. 851, and 7542 Herb. Bur. Sci. Philippine Islands, Manila; Fitzpatrick Herb. Nos. 1560, 1566, and 1721 (material collected on *Podocarpus costata* on Mt. Banajao, Laguna Province by Otto Reinking and E. B. Copeland; communicated by the collectors); Nos. 851 and 3639 Herb. H. Rehm (material collected by E. B. Copeland on Mt. Banajao); No. 910 Herb. H. Rehm (material collected on Mt. Banajao by F. C. Gates).

4. CORYNELIA UBERATA Fries ex. Acharius, Systema Mycologicum **2**: 535. 1822

*?Mucor clavatus* Linnaeus fil. Species Plantarum Suppl. 453. 1781.

*?Lichen* (*Calicium*) *helopherus* Acharius, Lichenographiae Svecicae Prodromus 86, 1798.

*?Sphaeria turbinata* Persoon, Synopsis Methodica Fungorum 95. 1801.

*Corynelia uberata* Acharius, in Fries, Observationes Mycologicae **2**: 343, 344, *pl. 8, fig. 1 a-e.* 1818.

*Corynelia clavata* (Linnaeus) Saccardo, in R. Pirotta, Osservazioni sopra alcuni funghi. Nuovo Giornale Botanico Italiano **21**: 312–317. 1889.

ILLUSTRATIONS: Fries, Observationes Mycologicae **2**: *pl. 8, fig. 1, a–e.* Winter, Ber. Deut. Bot. Gesell. **2**: *figs. 4–8.* Cooke, Handbook of Australian Fungi, *fig. 242.* Lindau, in Engler und Prantl, Die Natürliche Pflanzenfamilien **1**[1]: *fig. 261 a–c.*

(Figures 13–18)

Stromata scattered, infrequently confluent, more or less definitely circular, 1–3 mm. in diameter, chiefly hypophyllous, but often amphigenous, caulicolous, and fructicolous, not usually erumpent before the delimitation of the perithecia, in section homogeneous and black or dark-brown, externally dull black and minutely roughened, bearing finally a crowded cluster of 20–50 or more perithecia; perithecia first making their appearance through the ruptured epidermis as hemispherical protuberances on the stroma, the ascigerous cavity being partially buried and pure white within; the young perithecium cartilaginous, soon attaining a characteristically conical form, the apex smooth and shining, the base rough and dull, later protruding farther and developing a cylindrical neck which becomes clavate by the pronounced enlargement of the tip; perithecium at maturity approximately 1 mm. in length, brittle, somewhat dumb-bell shaped, usually bent in the narrow, middle portion and appearing consequently inequilateral, this being especially pronounced in those individuals borne at the margin of the stroma; the swollen apex of the perithecium at maturity flattened and deeply cleft by one to several transversely running furrows, the resulting ridges usually breaking up into scales, giving the apex of the perithecium a pronouncedly shaggy appearance, finally dehiscent along the line of the middle furrow by a wide and deep split, the two lips pulling apart and usually recurving thus exposing the ashy to brown inner wall; asci 20–26 × 34–44 μ (p. sp.), 8-spored; spores 9–14 μ (mostly 12 μ) in diam.; pycnidia sometimes developed on the stroma; pycnospores elongated, 5–7 × 2 μ.

Parasitic on *Podocarpus elongata, P. latifolia, P. Nageia, P.*

*Thunbergii, P. costata, P. falcata,* and *P. gracilior.* Known thus far only from Africa, Japan, New Zealand (Cooke **8**) and the Philippine Islands, but probably occurs throughout the tropical and subtropical regions of the Eastern Hemisphere. It has presumably also a considerably wider host range.

There is evident in different collections of material considerable variation in the size and general appearance of the perithecia. In the material from Japan they are somewhat smaller than those of South African specimens. No other differences have, however, been correlated with these variations, and the writer believes that a single species is represented.

The material studied by the writer agrees well with the colored illustrations and the description of *Corynelia uberata* published by Acharius in the Observationes Mycologicae of Fries (**12**). Acharius in connection with this description cites *Mucor clavatus* L. and *Sphaeria turbinata* Pers. as synonyms. Moreover he (Acharius **1**) cites *Mucor clavatus* as a synonym in connection with the original description of *Lichen* (*Calicium*) *helopherus.*[12] No explanation of his failure to cite *L.* (*Calicium*) *helopherus* in the synonomy of *Corynelia uberata* can be given. Fries (**13**) uses the name *C. uberata* in Systema Mycologicum but Saccardo (**45**) selecting the earlier specific name of Linnaeus designates the species as *C. clavata* (L.) Sacc. Because the latter binomial has come into more common use in recent years it is important that the identity of *C. uberata* and *Mucor clavatus* be demonstrated if possible. We cannot be sure from an examination of literature that the specimens on which these two species were based were ever compared. The name *Mucor clavatus* was first used by the younger Linné (**29**) in connection with the follow-

[12] Fries in connection with the description of *C. uberata* in Systema Mycologicum cites *Lichen* (*Calicium*) *colpodes* Acharius as a synonym. This is evidently a mistake in citation since this species is given as *Lichen* (*Imbricaria*) *colpodes* by Acharius, and from the description clearly refers to another organism. Fries apparently had in mind *Lichen* (*Calicium*) *helopherus* Acharius which was collected at the Cape of Good Hope and is stated by Acharius to be identical with *Mucor clavatus* Linnaeus. It is worthy of note, however, that in the description of *Corynelia uberata* signed by Acharius in Observationes Mycologicae the name *Lichen helopherus* is omitted from the synonomy.

ing description: "*clavatus. Mucor perennis, stipite filiformi nigro, capitulo obtuso nigro glabro. Habitat in foliis Arborum. Refert puncta in frondibus Filicum.*" He fails to state where he obtained his material and the description certainly cannot be regarded as applying unquestionably to *C. uberata.* The identity of the two forms could be demonstrated, therefore, only by a comparison of the type materials. An authentic sypecimen of *Mucor calvatus* probably does not exist. The herbarium of Linnaeus and that of Sir J. E. Smith with which many of the younger Linné's specimens are incorporated have been examined for the writer by Miss E. M. Wakefield. She states that the only specimen in the herbarium bearing the name *Mucor clavatus* is labeled in an unknown handwriting, is on bark, not leaves, and is not a *Corynelia* at all, but *Calosphaeria princeps* as noted on the sheet by Berkeley and Massee. Moreover although Acharius, Persoon, and Fries cite *Mucor clavatus* in their publications an authentic specimen of this species is not present in any of their herbaria today.

A specimen of recently collected material from South Africa communicated by Miss Doidge was mailed to Professor O. Juel, curator of the herbarium of Elias Fries, with the request that he compare it with the original material of *Corynelia uberata* deposited at Upsala. He has supplied the following facts. A single specimen in the herbarium bears a label written by Fries as follows: "*Corynelia uberata* Fr. Cap. B. sp. Dedit Acharius, Exiguum, at characterist." It consists of a fragment of a leaf bearing two stromata, only one of which is well developed. Most of the perithecia have been broken away, only one or two being in good condition. These are, however, of the same shape and size as those on the specimen from Miss Doidge submitted for comparison. Since this specimen in the herbarium of Fries was received from Acharius and since it is the only specimen in the herbarium labeled by Fries as *Corynelia uberata,* we are justified in believing that it constitutes a portion of the type material of this species. Moreover in the herbarium of Thunberg at Upsala there is another specimen, also fragmentary, which bears the same data as the specimen of Fries and agrees with it in

every essential respect. This was, however, erroneously labelled *Sphaeria capitata.*[13] These two specimens are unquestionably according to Juel, parts of a single collection of material made by Thunberg on *Podocarpus falcata* at the Cape of Good Hope.

Authentic material of *Lichen* (*Calicum*) *helopherus* and *Sphaeria turbinata* are probably no longer in existence. A search for specimens of these species has been made for the writer in the herbarium of Acharius at Helsingfors, Finland, and in that of Persoon, at Leiden, Netherlands, but without success. Since Persoon (**39**) states that his material was received from Thunberg there is some reason for suspecting that *Sphaeria turbinata* Pers., *Lichen* (*Calicium*) *helopherus* Acharius, and *Corynelia uberata* Acharius were all founded on a single collection of material made by Thunberg (**53 54**) at the Cape of Good Hope. The descriptions were all prepared in such a manner, however, that a reasonable doubt remains as to the identity of the three forms. There is no reason for believing that any of these workers saw other than the material on which his own description was based. It seems best from every standpoint to accept for the species under consideration the name *Corynelia uberata.* There is certainly no justification for using the binomial *C. clavata* (L.) Sacc.

*Corynelia clavata f. fructicola* is the name applied by Rehm (**43**) to material collected at the Cape of Good Hope on *Podocarpus elongata,* and distributed as No. 1326a of Rehm's Ascomyceten. The name was applied to specimens occurring on the fruit of the host in contrast to those found on the leaves (*f. foliicola*). The writer has examined the specimen in Rehm's own herbarium, and feels that the use of these form names is undesirable since the fungus on the leaves is morphologically identical with that on the fruit. An examination of two sets of the same exsiccati shows that Rehm distributed as No. 1326b. under the name *C. clavata* a mixed lot of material of *C. oreophila* and *C. tropica* collected in Chili by Neger.

[13] Same as *Xylaria Schweinitzii* B. & C.

### MATERIAL EXAMINED

Cape Province: Rabenhorst-Winter, Fungi europaei No. 3149 (specimens in Ellis and Earle herbaria at N. Y. Bot. Gard., in Plant Path. herb. at Cornell University, and two numbers in herb. Rehm at Stockholm); de Thümen Mycotheca universalis No. 776 (in N. Y. Bot. Gard. Herb., and in Bot. Dept. Herb. at University of Michigan); Fitzpatrick Herb. No. 1197 (material found in phanerogamic herbarium at N. Y. Bot. Gard. on leaves of *Podocarpus elongata* distributed in Cape Fl. Spec. by Steudel of Esslingen, Germany); Fitzpatrick Herb. No. 1483 (material found in phanerogamic herbarium at Harvard Univ. on leaves of *Podocarpus sp.* collected by Harvey, and labeled ex. Herb. Collegii S. S. Trin. Dublin); Union Department of Agriculture, Mycological Herbarium Nos. 986, 5580, 7354, 7815, 8970, 8971, and 9739 (collected in various localities and on several different hosts, communicated by Miss Ethel M. Doidge, and deposited as Fitzpatrick Herb. Nos. 1622, 1613, 1621, 1614, 1617, 1616, and 1619 respectively); Rehm Ascomyceten No. 1326a (specimen in Herbarium of Rehm); Union of South Africa, Dept. Agric., Natal Herb. Nos. 917, 918 (material communicated by van der Bijl, and deposited in Fitzpatrick Herb. as Nos. 1575 and 1576 respectively; material of No. 1575 deposited also at Harvard University, at New York Botanical Garden, and as No. 12059 in Plant Path. herbarium at Cornell University); Fitzpatrick Herb. Nos. 1564 and 1565 (two additional collections of material communicated by van der Bijl).

Transvaal: Sydow, Fungi exotici exsiccati No. 185 (in N. Y. Bot. Gard. herb., in Plant Path. herb. at Cornell Univ., and in herb. Bur. of Sci., Manila); Union Department of Agriculture, mycological herbarium Nos. 1743, 7410, and 1770 (communicated by Miss Ethel M. Doidge, and deposited in Fitzpatrick herbarium as Nos. 1504–1506 respectively).

Zululand: Union Department of Agriculture, mycological herbarium No. 2027 (collected at Eshowe by J. B. Pole-Evans, communicated by Miss Ethel M. Doidge, and deposited in Fitzpatrick Herbarium as No. 1618).

Tropical East Africa: Fitzpatrick Herb. No. 1195 (material found in phanerogamic herbarium at N. Y. Bot. Garden. on leaves of *Podocarpus gracilior* collected by Whyte in 1898 and communicated by Roy. Hort. Bot. Gard. Kew); U. S. D. A. Bur. Pl. Ind. herb. (material found in phanerogamic herbarium of U. S. Nat. Museum on leaves of *P. gracilior*, No. 630548, collected by E. A. Mearns).

Japan: Fitzpatrick Herb. No. 1639 (material collected by S. Kawagae on Yaku Island, Prefecture Kagoshima on *Podocarpus Nageia*, communicated by G. Yamada, Morioko, Japan).

Philippine Islands, Laguna, Luzon: Fitzpatrick Herb. No. 1750 (material communicated by Otto Reinking).

### 5. **Corynelia nipponensis** sp. nov.

TYPE: in Fitzpatrick Herb. Nos. 1204 and 1644.

(Figure 19)

Stromata scattered, 1–4 mm. in diameter, hypophyllous, elongated at right angles to the long axis of the leaf, the epidermis rupturing by a definite transverse slit, occasionally more or less circular, bearing a crowded cluster of 10–40 or more perithecia; perithecium top-shaped, the sides tapering toward a narrowed base, smooth, the broad flat apex more or less rounded, and traversed by a shallow furrow which evidently marks the line of dehiscence; ruptured perithecia not seen; perithecia crushed, on the slide shown to consist of long, brown, parallel hyphae which give a characteristic and diagnostic appearance; asci 30–42 × 17–27 μ (p. sp.), 8-spored; spores 8.5–11 μ (mostly 10 μ) in diam.

Parasitic on *Podocarpus macrophylla* Don. in Japan.

Only a single collection of this species is known to the writer. Material of *Podocarpus macrophylla* collected in Japan was received at the Royal Botanic Gardens at Kew in January, 1893, from the Science College of the Imperial University of Japan and was placed in the phanerogamic herbarium. The place and date of the collection and the collector's name are unknown. George Massee found material of a species of *Corynelia* on this specimen and placed it in the cryptogamic herbarium. This is labeled in

his own handwriting: "*Corynelia uberata* Fr. on *Podocarpus macrophylla* Don., Japan." A portion of this specimen was later sent to the New York Botanical Garden and is in the herbarium there. The writer has studied the specimen in the New York Botanical Garden, and has received also for comparison a portion of the material deposited at Kew. The two specimens are clearly the same thing. The fungus is not, however, *Corynelia uberata*. The perithecia are of greater diameter than those of *C. uberata*, and differ from them in shape and general appearance. It is unfortunate that more material showing the fungus in all stages of development is not available for examination, but there can be no doubt that this represents a hitherto undescribed species. It is of interest to note that *C. uberata* also occurs in Japan.

6. CORYNELIA OREOPHILA (Spegazzini) Starbäck, Arkiv. för Botanik **5**: 18–20, *pl. 1, fig. 13 a–c*. 1905.

*Alboffia oreophila* Spegazzini, Anal. Mus. Nac. Buen. As. **6**: 295, 296. 1898.

*Corynelia clavata* (Linnaeus) Saccardo p.p., Sylloge Fungorum **16**: 650. 1902.

ILLUSTRATIONS: Starbäck, Arkiv för Botanik **5**: *pl. 1, fig. 13 a–c*. 1905.

TYPE: The type material of *Alboffia oreophila* has been lost. Professor Spegazzini, in whose herbarium it was originally deposited, has, however, mailed to the writer material of another collection which he regards as the same. This material though young is unquestionably *Corynelia oreophila*. The original material on which *C. oreophila* was based is No. 301 Herb. Robt. Fries in the Riksmuseets Vetenskapsakademien, Stockholm, Sweden. A portion of the latter was communicated to the writer by L. Romell and is No. 1577 Fitzpatrick Herb.

(Figures 8–12, 39–41)

Stromatâ scattered, usually definitely circular to elliptical in outline, often erumpent before the delimitation of the perithecia, subcarbonaceous, the interior homogeneous and black, the surface

black and rough, amphigenous (chiefly hypophyllous, but a single stroma sometimes erumpent on both surfaces of the leaf), not observed to be caulicolous or fructicolous, bearing 7–100 or more perithecia; perithecia large, reaching 1.5 mm. in length, approximately 0.5 mm. in lateral diameter, in some cases much crowded and covering the whole surface of the stroma, in others scattered or developed only at the margin; young perithecium conical to short cylindrical, the apex smooth, rounded, and undifferentiated, the ascus-bearing cavity partially buried in the stroma, pure white within and the surface roughened with minute markings; mature perithecium very characteristic, the lower half globose to subcylindrical and roughened like the stroma, the upper half trisulcate and trilobed giving a triangular appearance in transverse section, smooth to shiny, the apex subtruncate and trilobed-umbilicate, the apical furrows running half way down the sides of the perithecium; dehiscence taking place along these furrows, the upper half of the perithecium becoming deeply tri-cleft, the three lobes pulling apart and turning back, exposing the lighter colored inner surface of the perithecial wall and giving a 3-pronged apex; in rare cases one or more perithecia on a stroma showing only a bilobed apex and resembling closely the typical perithecium of *C. portoricensis;* in other cases, an occasional perithecium quadrilobed, a condition also met with in *C. jamaicensis;* asci ellipsoidal to ovate, 22–30 × 34–42 μ (p. sp.), typically 8-spored, asci containing a fewer number of spores uncommon; spores 10–13.5 μ (mostly 12–13.5 μ) in diameter.

Parasitic on *Podocarpus angustifolia, P. Sellowii, P. chilina,* and *P. macrostachys.* Probably occurs also on other species of this genus. The type material collected on *P. angustifolia.*

*Corynelia oreophila, C. portoricensis, C. jamaicensis,* and *C. brasiliensis* are very closely related species. Of these *C. brasiliensis* is easily separated from the others by the wedge-shaped apex of its perithecium. *Corynelia oreophila* may be distinguished from the remaining two by its typically 8-spored ascus. In the material of this species studied less than 5 per cent. of the asci contain fewer than eight spores. A few 6-spored asci, fewer 5-spored asci, and one 2-spored ascus have been observed. This variation is not correlated with the variation in the number of lobes at the apex of the perithecium. Slides made from bilobed and quadrilobed individuals show typically 8-spored asci. In *Corynelia portoricensis* and *C. jamaicensis* approximately 80 per

cent. of the asci are 3-spored and the majority of the remainder are 2-spored. In relatively rare cases 1-spored, 4-spored, or 8-spored asci have been found, but when more than three spores occur in an ascus some of the spores are often imperfectly formed. One ascus with a single large normal spore and seven minute probably non-functional spores have been seen in *C. portoricensis* (Figure 42), but an ascus with eight perfectly formed, normal spores has not been observed in either of the two species.

The perithecium of *C. oreophila* is typically trilobed at the apex, bilobed and quadrilobed individuals occurring on the stroma among the typical individuals only in rare cases. In *C. portoricensis* the perithecium is typically bilobed but the occurrence of trilobed individuals is not uncommon, comprising approximately 11 per cent. of the cases. A quadrilobed individual has not been seen in this species. In *C. jamaicensis* the perithecium is typically trilobed and occasionally quadrilobed. Moreover a pentilobed apex has been noted on a single individual, but a perithecium with a bilobed apex has not been observed.

The perithecia are approximately the same size in the four species though there is some variation. The spores in *C. oreophila* and *C. brasiliensis* are somewhat smaller than those of *C. portoricensis* and *C. jamaicensis*. This fact is probably correlated with the number of spores in the ascus in the various cases. It has been observed that in *C. portoricensis* and *C. jamaicensis* the spore in a 1-spored ascus is relatively very large, the spores in a 2-spored ascus smaller, and those in a 3-spored ascus even smaller. This condition is probably merely a result of difference in nutrition.

The species *C. brasiliensis, C. jamaicensis,* and *C. portoricensis* have been founded on relatively few collections of material. *Corynelia oreophila* has, however, been studied from five widely separated localities in South and Central America. These five collections are identical as regards ascus and perithetical characters and show no more tendency in one case than in another toward the development of few-spored asci like those of *C. portoricensis* and *C. jamaicensis*. There is no reason, there-

fore, to assume that additional collections of material would furnish conditions intermediate between these species. Though admittedly closely related, they must be regarded as sharply demarcated and distinct. In the introduction to this paper an attempt is made to show how they have arisen from a common ancestor.

MATERIAL EXAMINED

Brazil: Herb. H. Rehm, No. 1881, Stockholm, Sweden (two packets of material collected by Ule, April, 1892); Fitzpatrick Herb. No. 1192 (material found in phanerogamic herbarium at N. Y. Bot. Gard. on leaf of *Podocarpus Sellowii* collected by Sellow and communicated to Herb. Columbia College, New York).

Chili: Rehm, Ascomyceten No. 1326b (two specimens in Bot. Dept. Herb. at Harvard Univ., one seen, both alike acc. Farlow; the specimen in Herb. C. E. Fairman, Lyndonville, N. Y., is *C. tropica*).

Columbia: Fitzpatrick Herb. No. 1484 (material found in phanerogamic herbarium at Harvard Univ. by A. J. Eames on leaves of *Podocarpus* sp. collected by Purdie).

Bolivia: Fitzpatrick Herb. No. 1577 (material communicated by L. Romell, of Riksmuseets Vetenskapsakademien, Stockholm, Sweden, from Herb. Robt. Fries No. 301 on *Podocarpus angustifolia;* part of the type material on which Starbäck founded *C oreöphila*).

Costa Rica: U. S. D. A. Bur. Pl. Ind. Herb. (material found in phanerogamic herbarium of U. S. National Museum by Miss Vera K. Charles on leaves of *P. macrostachys* No. 940952, collected at Volcan Poas, San Jose, by O. L. Jamenez).

7. **Corynelia brasiliensis** sp. nov.

TYPE: Material in herbarium of Elam Bartholomew at Stockton, Kansas, collected by F. Noack in the province of Sao Paulo, San Francisco dos Campos, Brazil, Dec. 1896, communicated by P. Sydow under the name *Corynelia oreophila* (Speg.) Starb. Slides showing asci and spores deposited in Fitzpatrick herbarium as No. 1630.

(Figures 4, 5)

Stromata scattered, circular to slightly elongated, sometimes erumpent before the delimitation of the perithecia, black, minutely roughened, amphigenous (chiefly hypophyllous) and caulicolous, not yet observed to be fructicolous, bearing 5–20 perithecia; perithecia approximately 1 mm. in length, in some cases crowded and covering the whole stroma, in others developed only at the margin of the stroma and radiating, the individual perithecia lying almost parallel to the surface of the leaf; the lower half of the mature perithecium subcylindrical, roughened like the stroma, and resembling closely the basal half of the perithecium of *C. oreophila;* the upper half, however, compressed laterally and definitely and broadly wedge-shaped; dehiscence occurring along the sharp edge of the wedge, the opposite faces of the wedge pulling apart and recurving, exposing the lighter colored inner surface of the perithetical wall; asci resembling those of *C. oreophila,* 8-spored; spores 10–12$\mu$ in diameter.

Parasitic on unidentified species of *Podocarpus* in Brazil.

In general appearance this species differs considerably from any other in the family on account of the wedge-shaped apex of the perithecium. The stroma and basal half of the perithecium are, however, very similar to the corresponding structures in *C. oreophila,* and a consideration of all the characters show these two species to be closely related. Both have typically 8-spored asci. Although the normal mature perithecia in the available material of *C. brasiliensis* have the characteristic wedge-shaped apex, occasional small, atypical and apparently stunted perithecia developed on the same stromata are of a different form. Such perithecia occasionally show the trilobed apex typical of *C. oreophila* or the bilobed apex more common in *C. portoricensis.* This condition may perhaps be explained as reversion to an ancestral type. A theoretical consideration of this point is given in the introduction to this paper. In the specimens examined there are several hundred typical full-sized perithecia with wedge-shaped apices and a relatively insignificant number of atypical individuals. No few-spored asci have been observed.

MATERIAL EXAMINED

Brazil: Specimen in harbarium Elam Bartholomew at Stockton, Kansas, collected by F. Noack in the province of Sao Paulo, San Francisco dos Campos, Brazil, Dec. 1896, communicated by Sydow under the name *Corynelia oreophila* (Speg.) Starb.; two specimens of same collection in herbarium H. Rehm at Stockholm, Sweden; slides showing asci and spores deposited in Fitzpatrick herbarium as No. 1630; Herb. H. Rehm No. 1743, collected by Ule.

### 8. **Corynelia portoricensis** sp. nov.

*Corynelia clavata* var. *portoricensis* Stevens, Illinois Acad. Sci. Trans: **10:** 178–181. *fig.* 5. 1917.

ILLUSTRATIONS: Stevens l. c. *fig.* 5.

TYPE: in the herbarium of the University of Illinois, Porto Rican Fungi, No. 784. A portion of this specimen is deposited in Fitzpatrick herbarium as No. 1591.

(Figures 1–3, 42)

Stromata scattered, circular to elongated, often erumpent before the delimination of the perithecia, subcarbonaceous, the interior homogeneous and black, the surface black and rough, amphigenous (chiefly hypophyllous, a single stroma sometimes erumpent on both surfaces of the leaf), caulicolous and fructicolous, bearing approximately 1–30 (averaging 11) perithecia; perithecia large, reaching 1.5 mm. in length, young and old perithecia frequently occurring on the same stroma, the younger ones usually at the center and the maturer ones at the margin, the marginal individuals usually radiating and often lying almost parallel to the surface of the host; young perithecia conical to short cylindrical, the apex smooth, rounded, and practically undifferentiated, the ascigerous cavity partially buried and pure white within; mature perithecia of two types, the first with trilobed apices, the second with bilobed apices; the trilobed individuals greatly resembling in form and size the typical perithecia of *C. oreophila*, occurring usually in the center of the stroma, and relatively few in number (11%); the bilobed individuals considerably flattened laterally in the upper half, measuring approximately $0.5 \times 0.25$ mm. in lateral diameter, and so characteristic in shape that this species can be easily recognized

with a hand lens; the lower part of the perithecium subcylindrical and roughened like the stroma, the upper part much smoother, minutely verrucose, dull to shiny; the apex of the trilobed individuals, subtruncate, umbilicate, and triangular as in *C. oreophila,* that of bilobed individuals rounded, not angular, slightly swollen above and tapering gradually below, traversed by a prominent suture which crosses the apex and runs down the two broader sides of the flattened upper half of the perithecium to the upper limit of the roughened lower half, or in some cases extending practically to the base of the perithecium; the bilobed perithecium sometimes also encircled in the narrowed central portion by several indistinct transverse wrinkles which give it an ungulate appearnace; dehiscence of the trilobed individuals as in *C. oreophila,* the upper half of the perithecium becoming deeply tri-cleft; dehiscence of the bilobed individuals taking place along the entire length of the furrow, the two halves of the perithecium pulling apart and turning back, exposing the interior of the ascigerous cavity and the lighter colored inner surface of the perithecial wall; asci not differing in the bilobed and trilobed perithecia, clavate to ovate, 14–25 × 25–50 μ (p. sp.), typically (80%) 3-spored, the spores borne in a single row or forming a triangular group, approximately 15% of the asci 2-spored, asci containing a larger number of spores uncommon, 1-spored asci occasionally found, one ascus containing one normal spore and seven minute, elongated, flattened and probably non-functional spores seen (Figure 42), but an ascus containing eight normal spores not observed; spores 10.5–16.5 μ in diameter (usually 12–13.5μ, imperfectly formed spores more minute, and usually elongated and flattened.

Parasitic on *Podocarpus coriacea* near Maricao, Porto Rico. Not known on other hosts, or from other localities.

In general appearance this species differs markedly from any other in the family on account of the bilobed perithecia. The characters of the asci and spores are practically identical with those of *C. jamaicensis.* In *C. jamaicensis,* however, the perithecium is typically trilobed, occasionally quadrilobed, very rarely pentilobed, but in no case yet observed bilobed. In *C. portoricensis* it is typically bilobed, occasionally trilobed (11 per cent. of the cases), but in no case yet observed quadrilobed. *C. oreophila* and *C. brasiliensis* differ from *C. portoricensis* both in having typically 8-spored asci and in the form of their perithecia.

Since these species are all closely related, the examination of abundant material was desirable as having a bearing on the question of their possible inclusion in a single species. In *C. portoricensis* plenty of material was available and a count of the 2-lobed and 3-lobed perithecia gave the following results. On 281 stromata examined there were 344 3-lobed perithecia in a total of 3025 individuals, or approximately 11 per cent. In other words a cluster of 10 perithecia contains on the average a single 3-lobed individual, the remainder being 2-lobed. Practically no variation from this percentage was obtained after the first 500 individuals were counted. Moreover on an average 11 perithecia are developed on a stroma although the limits are from 1 to 33. On only 1 of the 281 stromata examined were there more 3-lobed than 2-lobed perithecia. In this case the count was 7 to 4. On the other hand 1 stroma examined contained 33 2-lobed individuals to 1 3-lobed one, while stromata bearing as many as 20 2-lobed perithecia and no 3-lobed ones are frequent.

*Corynelia portoricensis* is described by Stevens (49) as *C. clavata* var. *portoricensis*. It is clearly much more closely related to *C. oreophila* than to *C. clavata* (*C. uberata*). The latter species is unknown from the Western Hemisphere.

### MATERIAL EXAMINED

Porto Rico: Brooklyn Botanic Garden, New York Botanical Garden, Cornell University, Exploration of Porto Rico. No. 698 (material collected by H. H. Whetzel and E. W. Olive and deposited at the three above named institutions and at Harvard Univ.: that at Cornell University Pl. Path. herb. No. 9655, Fitzpatrick Herb. No. 1021 and Whetzel Herb. No. 698); New York Botanical Garden, Carnegie Institution of Washington, United States National Museum, West Indian Exploration 1913, No. 2462 (material collected by N. L. Britton, F. L. Stevens and W. E. Hess; specimen at N. Y. Botanical Garden studied, portion of it in Fitzpatrick Herb. No. 1194); Herbarium University of Illinois, Porto Rican Fungi No. 784 (*type*, part of it deposited as Fitzpatrick Herb. No. 1591).

9. **Corynelia jamaicensis** sp. nov.

*Corynelia clavata* (Linnaeus) Saccardo p.p. in Hennings, Hedw. 37: 281. 1898.

TYPE: Flora Jamaicensis No. 6629 (material collected Aug. 10, 1896 by Wm. Harris on *Podocarpus purdieana* near the hotel "Holly Mount" on Mount Diablo, Jamaica).

(Figures 6, 7)

Stromata scattered, usually circular to elliptical in outline sometimes more elongated, 1.5–3 × 1.5–7 mm., subcarbonaceous, hypophyllous, not observed to be caulicolous or fructicolous, bearing 20–100 or more crowded perithecia; perithecia forming on the buried stroma and erumpent when small, or developing later on the raised stroma; young perithecium as in *C. oreophila;* mature perithecium, large, reaching 1.5 mm. in length, approximately 0.5 mm. in lateral diameter, usually trisulcate and trilobed as in *C. oreophila;* quadrilobed individuals more common than in that species, and pentilobed individuals occasionally found; bilobed individuals never observed; dehiscence taking place along all the furrows so that a quadrilobed individual after dehiscence has a four-pronged apex; asci clavate to ovate, 15–27 × 28–42 μ (p. sp.), typically (80%) 3-spored (the spores in a single row or arranged to form a triangle), approximately 15 per cent. of the asci 2-spored, asci containing a larger number of spores uncommon, an 8-spored ascus not observed; spores 11–15μ in diameter; imperfectly formed spores more minute and usually flattened.

Parasitic on *Podocarpus purdieana* in Jamaica and known only on this host from the type locality. To be expected in other islands of the West Indies and on the mainland of South and Central America.

In general appearance of stroma and perithecium resembling *C. oreophila.* Characters of asci and spores practically identical with those of *C. portoricensis,* the tendency toward 1-spored asci being perhaps slightly more pronounced in this species than in *C. portoricensis.*

MATERIAL EXAMINED

Jamaica: Flora Jamaicensis No. 6629 (*type* material from the herbarium of Wm. Harris in Jamaica communicated by S. F.

Ashby and deposited in Fitzpatrick Herb. as No. 1561, also material deposited in N. Y. Bot. Gard. Herb.).

## DOUBTFUL OR EXCLUDED SPECIES

1. CORYNELIELLA CONSIMILIS Hariot & Karsten, Rev. Mycol. 12: 128. 1890

(Figure 46)

This species was founded on a single collection of material from the island of Mauritius, and the writer has been unable to find any record of its subsequent collection. It was made the type of a new genus, and the genus is still monotypic. The original description is brief, a stroma is not mentioned, and no statement is given concerning the nature of the substratum. The fungus is not described as parasitic.

Lindau (**28**) includes the genus in the Coryneliaceae and states that a stroma similar to that of species of *Corynelia* is present. In his characterization of the family Coryneliaceae he states, moreover, that all the species are parasitic on leaves.

Through the courtesy of Professor L. Mangin, the writer has been enabled to examine a portion of the type material of this species, and the following facts are of interest. The perithecia occur on the bark of an unidentified woody plant and a stroma is absent. The bark is covered by a thin, white, waxy layer, resembling a resinous excretion, and the prominent, large, black perithecia are partially imbedded in the bark beneath this. The perithecia are usually solitary, but two or more are sometimes found close together. The shape of the perithecium cannot be determined from the material, the tips of all the individuals available for examination having been crushed. They are perhaps flask-shaped as described, but the species should be collected again and this point either confirmed or disproved. A microcopic examination of the type material shows the asci and spores in good condition. The ascus is cylindrical and 8-spored. Filiform paraphyses are present in abundance. The ascospores, at first greenish, are later brown, uniseriate, oblique, 3-septate and ellipsoidal. There is no reason for believing that the species is parasitic.

The absence of a stroma, the cylindrical non-stipitate character of the ascus, the abundance of paraphyses, and the septation of the spores all indicate that *Coryneliella consimilis* is not closely related to the Coryneliaceae. Since nothing is known, however, concerning the dehiscence of the perithecium, the proper position of the species in classification cannot be given.

2. CORYNELIA POCULIFORMIS Kunze, in Weigelt Surinam Exsic. 1827

*Hypoxylon* (*Bacillaria*) *poculiforme* Montagne, Ann. Sci, Nat. Ser. 2. **13**: 354. 1840.

*Sphaeria poculiformis* (Montagne) Léveillé, Ann. Sci. Nat. Ser. 3. **5**: 257. 1846.

*Leviellea poculiformis* Fries, Summa. Veg. 409. 1849.

*Phylacia poculiformis* (Kunze) Montagne, Ann. Sci. Nat. Ser. 4. **3**: 135 1855

Winter (**55**) states that he has studied the type material of this species collected by Weigelt in Surinam, and finds that it is not a *Corynelia*. I have seen the figures given by Montagne (**31**) and the fungus figured is certainly not one of the Coryneliaceae.

3. HYPSOTHECA THUJINA Ellis and Everhart, Jour. Mycol. **1**: 129. 1885. Also in North American Pyrenomycetes 199, 200. 1892

Ellis founded this species on material collected on *Chamaecyparis thyoides* at Newfield, New Jersey, and gives a detailed description of both the pycnidial and ascigerous stages. The fungus is evidently closely related to the other species described by him in the genus *Hysotheca*. The original collection of material has been lost, however, and in so far as the writer has been able to discover a second collection has never been made. The type material is not in the Ellis herbarium at the New York Botanical Garden, or in the set of Ellis types at Harvard University. A search for the species was recently made by Doctor E. W. Olive and the writer at Newfield, New Jersey, the type

locality, but, although the host was extremely abundant, the fungus was not found. In 1918 Doctor Olive and Professor H. H. Whetzel searched for the fungus at Lakehurst, New Jersey, but failed to find it. Since the writer has seen no material, it seems best to omit the species from the present monograph. If incorporated here it would probably bear the name **Caliciopsis thujina** (E. & E.) comb. nov.

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LITERATURE CITED

1. **Acharius, Erik.** Lichenographiae Sueciae Prodromus. 86. 1798.
2. **Auerswald, B., and Rabenhorst, L.** *Endohormidium tropicum* Awd. et Rbh., in Rabenhorst Fungi Europaei Exsiccati No. 1261. 1869. (Same in Hedw. **8**: 89. 1869.)
3. **Baker, C. F.** The lower fungi of the Philippine Islands. Leaflets of Philippine Botany, **6**: 2116. 1914.
4. ———. Final supplement to the list of the lower fungi of the Philippine Islands. Leaflets of Philippine Botany, **7**: 2469. 1914.
5. **Berkeley, M. J.** On a collection of fungi from Cuba. Part II. including those belonging to the families Gasteromycetes, Coniomycetes, Hyphomycetes, Phycomycetes, and Ascomycetes. Jour. Linn. Soc. Bot., **10**: 391. 1869.
6. **Berlese, A. N., and Voglino, P.** Corynelieae Sacc. in litt. Additamenta Sylloge Fungorum. 193, 194. 1886.
7. **Cooke, M. C.** Undescribed fungi in the Kew herbarium. Grev., **8**: 34. 1879.
8. ———. Handbook of Australian Fungi. 318. *fig. 242.* 1892.
9. **Cooke, M. C., and Ellis, J. B.** New Jersey Fungi. Grev., **6**: 83. 1878.
10. **Ellis, J. B., and Everhart, B. M.** A new genus of Pyrenomycetes. Jour. Mycol., **1**: 128, 129. 1885.
11. ———. Hypsothèca Ell. & Everht. North American Pyrenomycetes. 199, 200. *pl. 22, figs. 1–5.* 1892.
12. **Fries, Elias.** Observationes Mycologicae. **2**: 343, 344. *pl. 8, fig. 1 a–e.* 1818.
13. ———. Systema Mycologicum, **2**: 534, 535. 1822. **3**: 340–342. 1832.
14. ———. Summa Vegetabilium Scandinaviae, etc. 409. 1849.
15. **Giesenhagen, K.** *Sorica Dusenii* n. gen. und n. sp. ein im farnsorus lebender Askomycet. Ber. Deut. Bot. Gesell., **22**: 191–196. *pl. 13.* 1904.
16. ———. *Capnodium maximum* B. & C. Ber. Deut. Bot. Gesell., **22**: 355–358. 1904.
17. **Hariot, P., and Karsten, P.** Fungi novi. Rev. Mycol., **12**: 128. 1890.
18. **Hennings, P.** Beiträge zur Pilzflora Südamerikas II. Hedw., **36**: 230. 1897.

19. ———. Fungi jamaicensis. Hedw., **37**: 281. 1898.
20. ———. Die Gattung Pericladium Passer. Beiblatt zur Hedw., **39**: 76. 1900.
21. **Höhnel, Franz v.** Fragmente zur Mykologie XII. Mitteilung. Sitzber. Kais. Akad. Wiss. Wien (Math.-Nat. Kl.), **119**: 625. 1910.
22. ———. Fragmente zur Mykologie XIII. Mitteilung. Sitzber. Kais. Akad. Wiss. Wien (Math.-Nat. Kl.), **120**: 449, 450. 1911.
23. **House, H.** Report of the State Botanist 1917. N. Y. State Mus. Bull. 205–206: 44. 1919.
24. **Jaczewski, A.** Monographie du genre Sphaeronema Fries. Nouveaux Memoires de la Soc. Imp. des Nat. de Moscou, **15**: 353. *pl. 1, fig. 25.* 1898.
25. **Kalchbrenner, C.** Fungi Macowaniani. Grev., **10**: 146. 1882.
26. **Körber, Gustav W.** Parerga Lichenologica. 301. 1859–1865.
27. **Léveillé, J. H.** Description des champignons de l'herbier du museum de Paris. Ann. Sci. Nat. Ser. 3, **5**: 257–280. 1846.
28. **Lindau, G.** Coryneliaceae: in Engler und Prantl, Die Natürliche Pflanzenfamilien, **1**[1]: 411–413. *fig. 261.* 1897.
29. **Linnaeus, Carl.** Species Plantarum. Suppl. 453. 1781.
30. **Montagne, C.** Seconde centuries de plantes cellulaires exotiques nouvelles, décades III, IV, & V. Ann. Sci. Nat. Ser. 2, **13**: 354. 1840.
31. ———. Histoire Physique, Politique et Naturelle de l'Ile de Cuba. Bot. Plantes Cellulaires,—Cryptogames de Cuba—Atlas, *pl. 12, fig. 5.* Paris, 1838–1842.
32. ———. Cryptogamia Guyanensis seu Plantarum Cellularium in Guyana Gallica Annis 1835–1849 a Cl. Leprieur Collectarum Enumeratio Universalis. Ann. Sci. Nat. Ser. 4, **3**: 135. 1855.
33. **Nylander, W.** Addenda nova ad lichenographium europaeam. Flora, **65**: 451. 1882.
34. **Patouillard, N.** Fragments mycologiques. Jour. de Botanique, **3**: 258, 259. 1889.
35. **Patouillard, N., and Gaillard, A.** Champignons du Vénézuéla et principalement de la région du Haut-Orénoque récoltés en 1887 par M. A. Gaillard. Bull. Soc. Mycol. Fr., **4**: 105, 106. 1888.
36. **Patouillard, N., and Lagerheim, G. de.** Champignons de l'equateur. Bull. Soc. Mycol. Fr., **8**: 131. 1892.
37. **Peck, Chas.** Report of the Botanist. Ann. Rept. N. Y. State Mus. Nat. Hist., **33**: 32. *pl. 2, figs. 11–15.* 1880.
38. ———. New species of fungi. Bull. Torr. Bot. Club, **9**: 62. *pl. 24, figs. 8–12.* 1882. (Review in Rev. Mycol., **4**: *pl. 29, figs. 7.* 1882.)
39. **Persoon, C. H.** Synopsis Methodica Fungorum. 95. 1801.
40. **Pirotta, R.** Osservazioni sopra alcuni funghi. Nuovo. Giorn. Bot. Ital., **21**: 313, 314. 1889.
41. **Rehm, H.** Caliciеae; in Rabenhorst Kryptogamen Flora, **3**: 382–414. *30 figs.* 1896.
42. ———. Beiträge zur Pilzflora von Südamerika. Hedw., **37**: 321–328. *figs. 1–16.* 1898.
43. ———. Ascomycetes exs. fasc. 27. Beiblatt zur Hedw., **39**: 192. 1900.

44. ———. Ascomycetes Philippinenses III. The Philippine Journal of Science. C. Botany, **8**: 402. 1913.

45. **Saccardo, P. A.** Sylloge Fungorum, **1**: 74. 1882; **3**: 732. 1884; **8**: 833, 834. 1889; **9**: 441, 1073. 1891; **10**: 72. 1892; **11**: 385. 1895; **16**: 650. 1902; **17**: 621. 1905; **22**: 513. 1913.

46. **Salmon, E. S.** On *Oidiopsis taurica* (Lév.), an endophytic member of the Erysiphaceae. Ann. Bot., **20**: 187–200. *pls. 13, 14.* 1906.

47. **Spegazzini, Carolo.** Fungi Argentini novi v. critici. Anal. Mus., Nac. Bs. As., **6**: 295, 296. 1898.

48. **Starbäck, Karl.** Ascomyceten der schwedischen Chaco-Cordilleren Expedition. Arkiv. för Botanik, **5**: 18–20. *pl. 1, figs. 13, 14.* 1905.

49. **Stevens, F. L.** Porto Rican fungi, old and new. Trans. Ill. Acad. Sci., **10**: 178–181. *figs. 5, 6.* 1917.

50. **Sydow, H., and P.** Fungi in Wissenschaftliche Ergebnisse der Deutschen Zentral-Afrika-Expedition 1907–1908 unter Führung Adolf Friedrichs, Herzogs zu Mecklenburg II. 100. 1910.

51. ———. Fungi africani novi. Engler Botanische Jahrbücher, **45**: 264. 1910.

52. **Sydow, H., and P., and Butler, E. J.** Fungi Indiae Orientalis III. Ann. Mycol., **9**: 406. 1911.

53. **Thunberg, Carl P.** Prodromus Plantarum Capensium, Quas in Promontorio Bonae Spei Africes Annis 1772–1775 Collegit. 176. 1800.

54. ———. Flora Capensis, Sistens Plantas Promontorii Bonae Spei Africes, Secundum Systema Sexuale Emendatum, Redactas ad Classes, Ordines, Genera et Species Cum Differentiis Specificis, Synonymis et Descriptionibus. ed. III. 743. 1823.

55. **Winter, G.** Concerning the genus Corynelia. Ber. Deut. Bot. Gesell., **2**: 120–123. *figs. 1–8.* 1884.

56. **Wolf, F. A.** The perfect stage of *Actinonema Rosae*. Bot. Gaz., **54**: 218–234. *pl. 13.* 1912.

57. **v. Zwackh-Holzhausen, Wilhelm.** Die Lichenen Heidelbergs, nach dem Systeme und den Bestimmungen Dr. William Nylander's. 81. 1883.

# PENICILLIUM SPICULISPORUM, A NEW ASCOGENOUS FUNGUS

S. G. LEHMAN

(WITH PLATE 19)

The organism herein described first appeared in cultures from rootlets of apparently healthy cotton plants taken from a field in Anson County, N. C. In making the original cultures short pieces of rootlets were first washed, then treated with 50 per cent. solution of alcohol, rinsed in sterile water and placed into tubes of steamed rice. Some three or four weeks later the original cultures were observed to contain a fungus which had formed great numbers of perithecia of the type belonging to the Aspergillaceae. When ascospores from these perithecia were planted in potato glucose agar in petri dishes, white spreading colonies developed producing, first, a sparse crop of penicillate conidial fructifications and later, perithecia identical with those in the original cultures. The structure of the condial fructifications places this fungus definitely in the genus *Penicillium*, and a comparison of its morphological and cultural characters with those of other species of this genus as given in descriptions published by Saccardo (1), Lafar (2), Engler and Prantl (3), Thom (4), Sopp (5), Sartory (6) and Sartory and Bainier (7–10) shows it to differ from any of these in one or more important features. It is, therefore, described as a new species and since the walls of the ascopores bear minute spines, it is designated **Penicillium spiculisporum.**

Work with this fungus has shown that perithecia are produced in abundance on a wide variety of media without special cultural methods, a character rendering improbable the assumption that anyone could have cultivated this fungus without having observed them. This habit of abundant and continued perithecial formation coupled with sparse conidial production, a character not at all usual to species of *Penicillium*, is possessed in common

by *P. luteum* Zukal (11), *P. avellaneum* Thom and Turreson (12) and the species herein described. Its morphology, the production of transient yellow color in limited areas on certain media, and the general production of yellow associated with perithecia on potato plugs seem to place *P. spiculisporum* in the luteum-purpurogenum series as defined by Thom (1).

## DESCRIPTION OF THE ORGANISM

Conidia sown on potato or bean agar and kept at 28° C. germinate in great numbers within ten hours by first swelling, then putting out one to three tubes (Fig. 18). These hyphae rapidly branch, and, by the end of 48 hours, form a growth easily visible to the eye. From these centers low spreading colonies develop with white floccose surface consisting of aerial mycelium bearing a sparse crop of conidiophores as short lateral branches. The mycelium is hyaline, septate, branched, often forked at the apex, 2–3.5 $\mu$ in diameter (Fig. 1–3). Numerous perithecial initials may appear within two weeks, giving the surface a granular appearance. White is the predominating surface color, but this may change to cream, yellow or pinkish as the perithecia mature. The yellow color is often transient, fading again to white or cream. Infrequently in tube cultures, portions of the surface are made to appear gray by a profuse development of conidia.

Conidiophores are short, 10–50 $\mu$ by 2–2.5 $\mu$, usually 14–20 $\mu$ long, and bear a single verticel of three to five conidiiferous cells (Figs. 9–12). Occasionally there are only one or two or as many as six conidiiferous cells in a verticel (Fig. 5–8). Frequently the conidiophore produces a side branch bearing a single chain of conidia (Fig. 13) or, less frequently, it may carry at its summit two metulae each of which bear verticels of three to five conidiiferous cells (Fig. 14). If the conidial fructification occupies the end of an aërial hypha, the conidiiferous cells may be loosely disposed over a distance of 40–50 $\mu$ back from the apex (Fig. 15).

Conidiiferous cells are 11–16 $\mu$ long by 1.8–2.5 $\mu$ in diameter at the thickest part, the distal third of each cell tapering to a

sterigma of half this diameter (Fig. 7–9). Conidial chains may attain a length of 85 $\mu$, easily break apart in water mounts and do not form columns. Conidia are ovate, elliptical or globose, 2.5–4 $\mu$ by 1.8–2.5 $\mu$ in six-day old drop cultures, have smooth walls and appear hyaline under the microscope (Fig. 16, 17). However, when they form in profusion, as infrequently happens in small areas, the surface appears gray with a faintly perceptible shade of green or brown according to the density of the growth. They swell and produce one to three tubes in germination.

If cultures on steamed rice and potato plugs in tubes, or on potato- and bean-glucose agar in petri dishes, are kept at 35 degrees Centigrade, great numbers of perithecia will be found developing at the end of two weeks. If crushed mounts are made at the end of 20 days, great numbers of asci and ascospores may be found in all stages of development. Perithecia are at first white, and may remain so; but, within thirty days, the color may have changed so that white, cream, pink and yellow shades may appear, all of which may be present in the same culture. The yellow is often transitory, fading again to cream or white.

Perithecial formation begins with the twisting together of the ends of two or more hyphae to form a knot (Fig. 19). Other hyphae grow out from and weave around this knot, gradually enlarging it and forming a white hyphal gnarl. When this gnarl has nearly attained mature size, the cells of the hyphal branches within swell and are transformed to asci (Fig. 23–28). When this process of development is complete, the perithecial cavity is found to be closely packed with ascospores, the delicate ascus walls and all hyphae having entirely disappeared. Perithecia are spherical, except when crowded, 0.4–2 mm. (mostly 0–5.1 mm.), indehiscent, with a peridium consisting of three parts: a thin inner layer of closely woven hyphae, a thick middle layer of loosely woven threads, and a very narrow outer layer (Fig. 20–22). The hyphae constituting the middle layer and the outermost layer of the peridium are of less diameter than those composing the innermost layer and the ascogenous center.

Asci are globose, elliptical, or pyriform, 7.2–10.8 by 6.3–7.7 $\mu$, hyaline, 6–8-spored, the walls disappearing as the spores mature

(Fig. 30–34). Ascospores are ovate to elliptical, 2.5–4 $\mu$ by 1.8–2.8 $\mu$, with walls bearing minute spines (Fig. 35). The spines are visible only under oil immersion, and then to best advantage when the spores have been treated three to five minutes with alcohol carbol fuchsin as if staining bacteria. Only about one per cent. of the ascospores have germinated on any of the various media used. Fig. 37 represents a colony grown from a single ascospore on beef peptone agar kept at 28° C. for 48 hours. At 72 hours, this colony had attained a diameter of 675 $\mu$ and had developed a few conidiophores with chains of six to ten spores.

**Penicillium spiculisporum** sp. nov.

Coloniis in agaro Solani tuberosi vel Phaseoli cultis, albis, rare instabiliter sulphureis, floccosis, extendentibus incerte; reverso albo aut cremeo. Conidiophoris sparis, ex hyphis aereis orientibus, 10–50 $\mu \times$ 2–2.5 $\mu$, usitate unum verticillum 1–6 basidiorum vel rare 1–2 metulorum vel basidiorum et metulorum gerentibus; basidiis 11–16 $\mu \times$ 1.8–2.5 $\mu$, contractis ad apices; conidiis ovatis, ellipticis vel globosis, hyalinis vel pallide glaucis in massa, 2.5–4 $\mu \times$ 1.8–2.5 $\mu$, levibus. Peritheciis abundantibus, globosis, primo albis, diende cremeis vel sulphureis, citrinis, flavis vel luteis, 0.4–2 mm., nondehiscentibus, peridiis non parenchymaticis, ex tribus ordinibus hyphorum, compositis; ascis globosis, ellipticis vel pyriformis, 7.2–10.8 $\mu \times$ 6.3–7.7 $\mu$, hyalinis, 6–8 sporis; ascosporis ovatis, ellipticis, hyalinis, spinulosis, 2.5–4 $\mu \times$ 1.8–2.8 $\mu$. Coloniis gelatinam nonliquifacientibus. Odore nullo. Aeris temperatione optima 33–35° C. Culturae ex Gossypio herbacearo Anson Co., N. C., U. S. A.

CULTURAL CHARACTERS

Potato agar, good growth, spreading colonies with low, white, floccose surface; glucose or saccharose added, vigorous growth, many perithecia formed; surface white or transiently yellow, reverse white to cream.

Potato plugs, vigorous growth soon forming a dense mat of white mycelium, and, later, numerous white, cream and yellow perithecia.

Bean agar, same as for potato agar but somewhat less vigorous.

Beef peptone agar, colonies remain small, surface velvety with conidial fructifications arising from immersed hyphae.

Steamed rice, good growth, numerous white, cream, pinkish or yellow perithecia within 30 days.

Fifteen per cent. gelatin, sparse growth, not liquidified in 30 days at 28° C.

Milk, very little, if any, growth.

Czapeck's solution agar (nitrogen omitted) to which the following substances were added:

Saccharose 3 per cent., poor growth, no perithecia.

Glucose, 3 per cent., poor growth, no perithecia.

Maltose, 3 per cent., good growth, many sulphur colored perithecia at 14 days, reverse faint cream.

Lactose, 3 per cent., very poor growth, no perithecia.

Galactose, 3 per cent., good growth of rapidly spreading colonies, few sulphur colored perithecia at 14 days.

Glycerin, 3 per cent., good growth, many cream-colored perithecia at 14 days, reverse white and cream.

Armour's peptone, 3 per cent., poor growth, no perithecia, reverse cream.

Armour's peptone, 3 per cent., and saccharose, 3 per cent., vigorous growth forming a dense mat of mycelium, few perithecia, surface floccose and gray with conidial fructifications, reverse dark cream.

Asparagin, poor growth, saccharose added, very good growth, many small perithecia.

Urea, no growth.

Potato starch, fairly good growth, many small perithecia, colonies surrounded by a wide circle of clear media from which the starch has been dissolved by an enzyme.

Butterfat, very poor growth.

Temperature relation: On bean- or potato-saccharose agar growth is slow at 20° C., good at 28, optimum at 33–35, good at 40.

Color: White is the predominating surface color; however, when conidia form in profusion, as infrequently occurs in small areas, or over the entire surface when certain substances are

added to the substratum, the surface appears gray with faint shades of green and brown. Other pigments are associated with the perithecia. These bodies are at first white, and may remain so indefinitely, but very often they become cream, pinkish or some shade of yellow. All these colors may be present in a single tube of steamed rice. The yellow varies in shade from sulphur through lemon-yellow to yellow and may deepen to golden-yellow in our cultures (13). Yellow is often transitory and erratic coming on comparatively few, if any, perithecia of a given rice culture, and usually fading to cream or white within a week or infrequently deepening to golden yellow. On potato plugs yellow is less transitory and more certain to develop. The reverse of petri dish cultures is often cream in color and pink is frequently seen in small mycelial areas in rice tubes.

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REFERENCES

1. **Saccardo, P. A.** Sylloge Fungorum.
2. **Lafar, Franz.** Handbuch der Technischen Mykologie, **4**: 219–234. 1906
3. **Engler, A., and Prantl, K.** Die Natürlichen Pflanzenfamilien. Teil 1, Abteilung, 1: 304–306. 1897.
4. **Thom, Charles.** Cultural Studies of Species of *Penicillium*. U. S. D. A. Bur. Animal Indus. Bull. 118. 1910.
5. **Sopp, Johan-Olson.** Monographie der Pilzgruppe *Penicillium* mit Besonderer Berücksichtigung der in Norway Gefundenen Arten. Skrifter utgit Videnskapsselskapet i Kristiania f. 1912, I Mat.-Nat. Cl. 1. Band, Nr. 11, Kristiania 1912: 208 pages 23 Taf., 1 Textfig.
6. **Sartory, A.** Etude d'un *Penicillium* nouveau, *P. Gratioti* n. sp. Annal. Mycol., **11**: 161–165. *pl. 9.* 1913.
7. **Sartory, A., and Bainier, G.** Etude d'un *Penicillium* nouveau, *P. Herquei* n. sp. Bul. Soc. Mycol. France, **28**: 120–126. *pl. 7.* 1912.
8. ———. Etude de deux *Penicillium* nouveaux producteurs de pigments. Bul. Soc. Mycol. France, **28**: 270–280. *pl. 13.* 1912.
9. ———. Etude morphologique et biologique des deux *Penicillium* nouveaux (espéces thermophiles). Bul. Soc. Mycol. France, **29**: 367–377. 1913.
10. ———. Etudes morphologique et biologique d'un *Penicillium* nouveaux, *P. Petchii* n. sp. Annal. Mycol., **11**: 272–277. *pl. 14.* 1913.
11. **Thom, Charles.** The *Penicillium* Luteum-Purpurogenum Group. Mycologia, **7**: 134–142. *fig. 1.* 1915.
12. **Thom, Charles, and Turreson, G. W.** *Penicillium avellaneum.* A New Ascus-Producing Species. Mycologia, **7**: 284–287. *fig. 1–3.* 1915.
13. **Saccardo, P. A.** Chromotaxia. Tabellae Colorum, 1894.

EXPLANATION OF PLATE 19

All drawings were outlined and as many as possible of the details put in with the aid of the camera ludica. The reduced magnification can easily be calculated from the scale given with each group.

Figs. 1–3. Hyphae showing nature of contents, septation and manner of branching.

Fig. 4. Sketch of fructifications.

Figs. 5–15. Conidiophores showing various types of fructifications found in potato glucose agar plates.

Fig. 16. Conidia grown in starch agar plate. Drawing made from water mount.

Fig. 17. Conidia grown on potato glucose agar. Drawing made from material stained with alcoholic carbol fuchsin and mounted in balsam.

Fig. 18. Conidial germination in a 20-hour old potato glucose agar culture at 28° C.

Fig. 19. Beginning stages in perithecial development.

Fig. 20. Microtome section of a cluster of perithecia grown on steamed rice. The letter "*a*" locates the inner, "*b*" the middle and "*c*" the outer layers of the peridium.

Fig. 21. Microtome section of small perithecia grown on potato glucose agar in petri dish.

Fig. 22. The portion marked "*x*" of Fig. 21 much more highly magnified. Note the character of the peridium and the clusters of ascospores among the fertile hyphae.

Fig. 23. Swollen hyphae from the center of a young perithecium.

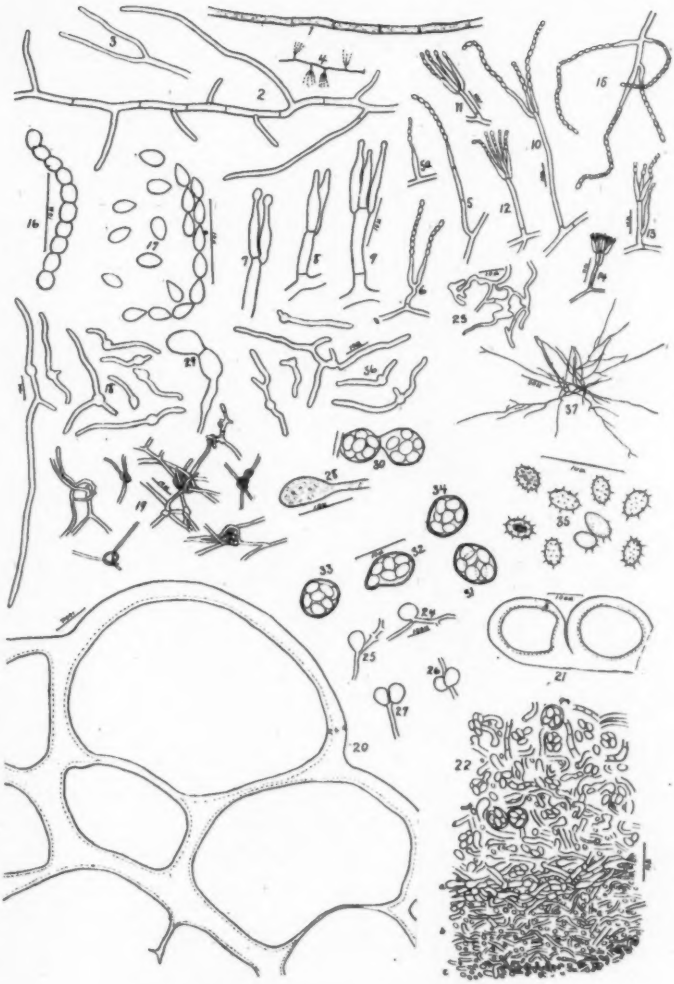
Figs. 24–29. Asci and hyphal attachments.

Figs. 30–34. Asci containing ascospores.

Fig. 35. Ascospores highly magnified. Note the spines on the walls. Drawing made from spores stained with alcoholic carbol fuchsin and mounted in balsam.

Fig. 36. Ascospores germinating in a 24-hour old culture of beef peptone agar kept at 28° C.

Fig. 37. Camera lucida sketch of 48-hour old colony on beef petone agar. This colony grew from an ascospore.



PENICILLUM SPICULISPORUM LEHMAN

# SOME USTILAGINEAE OF THE STATE OF WASHINGTON

GEORGE L. ZUNDEL

## INTRODUCTORY STATEMENT

No special effort has previously been made to list the Ustilagineae of Washington. Scattered through literature, however, there are a fairly large number of reports of smuts from Washington. It would be hard to find another state where more ideal conditions for mycological study exist, especially for the study of smuts and rusts. The state has an area of 69,180 square miles and a coast line of 1,860 miles, together with a varied topography and a climate ranging from one warm enough to raise figs to that of a very frigid character, and a variation of rainfall from less than 5 inches to over 130 inches, the fungous flora of the state is naturally varied.

Of the botanical collectors who have worked in the state a large proportion have found smuts. Among them are W. N. Suksdorf, David Griffitffihs, T. E. Wilcox, E. R. Lake and W. R. Hull, J. S. Cotton, R. M. Horner, C. V. Piper, R. K. Beattie. For the last five years the Plant Disease Survey of Washington, under the direction of Dr. F. D. Heald, has added to the smut collections of the state. Mr. W. N. Suksdorf has, perhaps, contributed most to our knowledge of Washington smuts. His collecting has been confined, however, to small areas, in Klickitat and in Skamania Counties, so that there are still counties in the state from which not a single smut has been reported. Mr. Suksdorf has also collected on Mt. Adams (Mt. Paddo, used by Suksdorf, is the old Indian name for Mt. Adams).

## SOURCE OF MATERIAL

The smuts reported in this list represent material from a number of sources.

(*a*) References taken from literature but no specimens examined.

(*b*) Specimens examined from various herbaria.

(*c*) Specimens sent to the author mostly by W. N. Suksdorf.

(*d*) Material in the herbaria of the department of botany and of the department of plant pathology of the State College of Washington. A number of these collections were found by reference to the "Parasitic Fungi of the Northwest" by Martin, now in process of publication.

(*e*) The author's own collection. Where no credit is given it is the author's own collection.

The writer has used the nomenclature of Clinton as it appears in North American Flora.

### LIST OF SPECIES

Arranged alphabetically for Genus, Species, and Host.

CINTRACTIA CARICIS (Pers.) Mag. Abh. Bot. Ver. Prov. Brand., **37**: 79. 1896.

On *Carex geyeri*, Mt. Adams (Mt. Paddo), Wash. Sept. 21, 1899 (W. N. Suksdorf, No. 554).

On *Carex* sp., Mt. Adams (Mt. Paddo), Wash. Aug. 11, 1885 (W. N. Suksdorf, No. 188).

CINTRACTIA SEYMORIANA Mag.

On *Panicum crus-galli*, Bingen, Klickitat Co., Wash. Oct. 3, 1894 (W. N. Suksdorf, No. 404). This name is now considered as a synonym of *Ustilago crus-galli*.

DOASSANSIA ALISMATIS (Nees) Cornu. Ann. Sci. Nat. VI. **15**: 285. 1883.

On *Alisma plantago*, Columbia River, W. Klickitat Co., Wash. May 23, 1884 (W. N. Suksdorf No. 165 as per letter of Jan. 13, 1920, from Dr. G. P. Clinton); Pullman, Whitman Co., Wash. Aug. 20, 1894 (Piper, No. 278, W. S. C. Herbarium).

DOASSANSIA MARTIANOFFIANA (Thüm) Schrot. Krypt. Fl. Schles., **3**: 287. 1887.

On *Potamogeton gramineus*, Falcon Valley, Klickitat Co., Wash. Aug. 1885 (W. N. Suksdorf No. 205 as per letter from Dr. G. P. Clinton of Jan. 13, 1920).

ENTYLOMA ARNICALE El. & Ev. Bull. Torr. Bot. Club, **22**: 57. 1895.

Type collected in Skamania County, Wash.—on leaves of *Arnica chamissonis*, 1891. Other collections on leaves of *Arnica cordifolia*, Latah County, Idaho, July 1893 (C. V. Piper No. 122).

ENTYLOMA COMPOSITARUM Farl. Bot. Gaz., **8**: 275. 1883.

On *Amsinkia intermedia*, Waitsburg, Walla Walla Co., Wash. May 28, 1900 (Horner, No. 1468—W. S. C. Herbarium).

On *Erigeron elatus* and *E. solsuginosus* (North American Flora, **7**: pt. 1, p. 62).

SPACELOTHECA REILIANA (Kühn) Clint. Jour. Myc., **8**: 141. 1902.

On *Zea mays*—20 acre patch north of Wash. State College, Pullman,

Whitman County, Wash.—40 per cent. infection mostly in tassel, Sept. 12, 1919 (Zundel and Williams). On Wash. State College Farm, Oct. 1919 (Dana).

SPACELOTHECA SORGHI (Link) Clint. Jour. Myc., **8**: 140. 1902.

On *Sorghum* sp. (cultivated), Forage nursery Washington State College, Pullman, Whitman Co., Wash. Sept. 10, 1915 (Heald and George C. S. No. 238); Yakima, Yakima Co., Wash. Oct. 10, 1918 (E. C. Scott, I. S. No. 1708); near Chelan, Chelan Co., Wash. Summer 1918.

TILLETIA ASPERIFOLIA El. & Ev. Jour. Myc., **3**: 55. 1887.

On *Sporobolus asperifolius*, Rockland, Klickitat Co., Wash. June 3, 1905 (W. N. Suksdorf No. 998); Yakima, Yakima Co., Wash. Aug. 1895 (Watt, W. S. C. Herbarium).

TILLETIA ELYMI Diet. & Hol. Bot. Gaz., **19**: 305. 1894.

On *Elymus* sp., Skamania Co., Wash. Aug. 13, 1886. Type collection (W. N. Suksdorf No. 336).

TILLETIA FOETENS (B. & C.) Trel. Par. Fungi. Wis. 35. 1884.

Collected on *Triticum* sp.—in Thurston Co., Grays Harbor Co., Island Co., and Lincoln Co., Wash. Summers of 1918–1919. The one sample from Lincoln County in 1919 is the only one known to have been collected in Washington, east of the Cascade Mountains.

TILLETIA FUSCA El. & Ev. P. B. I. Bull., **38**: 43. 1903; Jour. Myc., **3**: 55. 1887.

On *Festuca microstachys* and *F. octaflora*, 25 miles north of Prosser, Benton Co., Wash. Summer 1903 (David Griffiths). Fully three-fourths of all plants had been destroyed by the smut; Rattlesnake Mountains, Yakima Co., Wash. June 18, 1901 (J. S. Cotton in Flora of Yakima Region, 1901).

TILLETIA GUYOTIANA Har. Jour de Botanique, **1900**: 117. 1900.

Syn. *Thecophora guyotiana* Har. Mem. Soc. Acad. de l'Aube, **1887**: 195. 1887.

Sori replacing ovaries, somewhat flexible. Spores enmasse reddish-brown, spores yellowish, clear, globose, roughly elliptical, very elegantly reticulated, 19–25 $\mu$ diam.

On *Bromus hordaceus glabrescens*,

(*a*) Wedgewood Bros. Farm, Goldendale, Klickitat Co., Wash. Aug. 12, 1919 (Zundel & Cooney). Elevation 2200 ft.

(*b*) Three miles west of Goldendale, Klickitat Co., Wash. Aug. 12, 1919. Elevation 1900 ft.

(*c*) South end of Trout Lake, Klickitat Co., Wash. Aug. 13, 1919.

(*d*) White Salmon, Klickitat Co., Wash. Aug. 13, 1919.

(*e*) Staker's Canyon, Klickitat Co., Wash. Aug. 14, 1919.

(*f*) Seven miles east of Dixie, Walla Walla Co., on the foothills of the Blue Mountains. Sept. 28, 1919 (Zundel & Patton).

So far as the writer has been able to ascertain this is the first time that this smut has been reported from North America. Plants were found that were smutted with both *Ustilago bromivora* and *Tilletia guyotiana*. It is very abundant on the foothills of the Blue Mountains of Washington and all over Klickitat County, Wash. It is very inconspicuous and not easily found unless one knows exactly what to look for. The writer first found his specimen

when opening a gate for County Agent Cooney of Klickitat Co., when going into a wheat field. A piece of brome grass was picked and the kernel smashed. A dark dusty mass fell into his hand and a careful examination resulted in the finding of this smut.

TILLETIA RAUWENHOFFII Fisch. de Wald. Aperçu, p. 50.

Syn. *Tilletia holci* (West) Rost. Danish Fungi by J. Lind., **1913**: 266. 1913.

Sori irregular, in ovary of host, dark, spores reticulate, in two layers. An inner layer olive brown, an outer layer visible on the periphery of the spores, hyaline, side hexagonal, not very prominent hexagonal reticulations. Spores 22–30 $\mu$ diam.

On *Holcus lanatus*, Kelso, Cowlitz Co., Wash. Aug. 6, 1919.

Five collections at Kelso, Wash. Aug. 17, 1919. Not very abundant. This smut has previously been reported from Belgium and Denmark. So far as the writer is aware this is the first report of this smut from North America.

TILLETIA TRITICI (Bjerk.) Wint. Rab. Krypt. Fl., **1**[1]: 110. 1881.

On kernels of wheat, Bingen, Klickitat Co., Wash. Aug. 3, 1902 (W. N. Suksdorf No. 996).

Found on *Triticum* spp.—in every county of Washington. Most abundant in the Palouse region of eastern Washington. Causes an annual loss in the state of about $5,000,000.00.

USTILAGO AVENAE (Pers.) Jens. Charb. Céréales, 4. 1889.

On *Avena sativa*, Prevalent west of Cascade Mountains, rarely found east of the Cascade Mountains.

USTILAGO BISTORTORUM (DC.) Körn. Hedwigia, **16**: 38. 1877.

On *Polygonum* sp., Mt. Adams (Mt. Paddo), Wash. Aug. 7, 1885 (W. N. Suksdorf No. 198).

USTILAGO BROMIVORA (Tul.) Fisch. de Wald.—Bull. Soc. Nat. Mosc., **40**: 252. 1867.

On *Bromus eximius*, West of Ice Cave, Skamania Co., Wash. Sept. 9, 1902 (W. N. Suksdorf No. 1021).

On *Bromus hookerianus*, on banks of Columbia River, Klickitat Co., Wash. June 1883 (W. N. Suksdorf No. 66).

On *Bromus hordaceus*, Wawawai, Whitman Co., Wash. May 7, 1915 (George, W. S. C. Path. No. C. S. 26); Pullman, Whitman Co., Wash. July 1, 1915 (G. A. Olson, W. S. C. Path. No. C. S. 130); July 10, 1916 (Dana, W. S. C. Path. No. C. S. 360).

On *Bromus hordaceus glabrescens*, Coupeville, Island Co., Wash June 19, 1919; White Salmon, Klickitat Co., Wash. Aug. 13, 1919.

On *Bromus marginatus*, Aug. 18, 1904. Wentachee Mts., Chelan County, Wash. (Cotton—W. S. C. Herbarium).

On *Bromus* sp., Colfax, Whitman Co., Wash. July 19, 1919; Rosalia, Whitman Co., Wash. Aug. 1, 1919.

On *Bromus* sp., Washington State College Campus, Pullman, Whitman Co., Wash. July 2, 1918 (W. S. C. Path. C. S. No. 516) also July 1919; Puyallup, Pierce Co., Wash. July 16, 1919; Maryhill, Klickitat Co., Wash. Aug. 12, 1919; Stacker's Canyon, Klickitat Co., Wash. Aug. 14, 1919; LaConner, Skagit Co., Wash. Aug., 1919.

USTILAGO BROMIVORA MACROSPORA Farl. Bull. Iowa Agr. Coll. Bull. Bot. Dep., **1886**: 59. 1887.

On *Bromus tectorum*, Chelan Lake, Chelan Co., Wash. Aug. 27, 1916 (Weir No. 12496).

USTILAGO CLAYTONIAE C. L. Shear. Bull. Torr. Bot. Club, **34**: 317. 1907.

Type collected by Colonel T. E. Wilcox on *Claytonia linearis* Dougl. Vancouver Barracks, Vancouver, Clarke Co., Wash. Apr. 8, 1903; Campus Wash. State College, Pullman, Whitman Co., Wash. May 14, 1920 (Sullins & Zundel).

USTILAGO CRUS-GALLI. Tr. & Ear. Bull. Tor. Bot. Club, **22**: 175. 1895.

On *Panicum crus-galli*, Western Klickitat Co., Wash. (W. N. Suksdorf No. 3677, Specimen in herbarium of Dr. Jas. Weir, Spokane, Wash.).

On *Panicum milaceum* (Broom corn millet), Sunnyside, Yakima County, Wash. Oct. 19, 1915 (Heald & George No. I. S. 458).

USTILAGO ECHINATA Schröt. Abh. Schles. Ges. Abth. Nat. Med., **1869–72**: 4. 1870.

On leaves of *Phalaris arundinaceae*, collected on bottom land—Bingen, Klickitat Co., Wash. June 30, 1893 (W. N. Suksdorf No. 413).

USTILAGO HORDEI (Pers.) Kel. & Sw. Ann. Rep. Kans. Agr. Exp. Sta., **2**: 268. 1890.

On *Hordeum* spp. Throughout the state of Washington.

USTILAGO HYPODYTES (Schl.) Fr. B. P. I. Bull., **38**: 43. 1903. Syst. Myc., **3**: 518. 1832.

On *Distichlis spicata* (North Amer. Flora, **7**: 5. 1906).

On *Elymus condensatus*, Okanogan, Wash. Summer, 1903 (David Griffiths).

On *Eriocoma cuspidata*, on Big Bend Land Co., Northern Franklin Co., Wash. Aug., 1919. From material sent to Dr. F. L. Pickett, of the Washington State College Botany Department; Pasco, Franklin Co., Wash. April 21, 1920, on year old stalks of the grass.

On *Sitanion* sp., Mt. Adams (called by Indians Mt. Paddo), Wash. Sept. 30, 1904 (W. N. Suksdorf No. 980); Wenatchee, Chelan County, Wash. July 17, 1919 (Leonard).

On *Stipa* sp., Falcon Valley, Klickitat Co., Wash. July 10, 1900 (W. N. Suksdorf, No. 606*a*), Aug. 26, 1904 (W. N. Suksdorf No. 606*b*).

USTILAGO LEVIS (Kel. & Sw.) Magn. Abh. Bot. Ver. Prov. Brand., **37**: 69. 1896.

On *Avena fatua glabrata*, Oakesdale, Whitman County, Wash. July 29, 1919 (J. W. Hotson).

On *Avena* sp., Bingen, Klickitat Co., Wash. July 13, 1902 (W. N. Suksdorf No. 805).

This smut of oats is prevalent east of the Cascade Mountains. It is also found in western Washington (See Heald, F. D., "Oat Smuts in Washington" in Proc. Wash. State Grain Growers, Shippers and Millers Association, **1919**: 29).

USTILAGO MUFORDIANA El. & Ev. Bull. Torr. Bot. Club, **22**: 362. 1895.

On *Festuca microstschys* (?) or *F. reflexa* (?), Bingen, Klickitat Co., Wash. July 3, 1902 (W. N. Suksdorf No. 804).

On *Festuca tenella*, Bottom land of the Columbia River at Bingen, Klickitat Co., Wash. May 26, 1896 (W. N. Suksdorf No. 555).

USTILAGO NUDA (Jens.) Kel. & Sw. Ann. Rep. Kans. Agr. Exp. Sta., **2**: 277. 1890.

On *Hordeum* spp. (cultivated), Florence and Marysville, Snohomish Co., Wash. Summer 1919.

USTILAGO PERENNANS Rostr. Overs. K. Danske Vid. Selsk. Forh., **1890**: 15. March, 1890.

On *Arrhenatherum elatius* (escaped from cultivation and locally called Lincoln grass).

Wash. State College Farm, Whitman Co., Wash. May 1, 1919 (Wanser, W. S. C. Path. I. S. No. 1379); Trout Lake, Klickitat Co., Wash. Aug. 13, 1919.

USTILAGO PUNCTATA Clint. North Amer. Flora, **7**: 23–24. 1906.

On *Polygonum newberryi*, Mt. Adams (Indian name, Mt. Paddo), Wash. Sept. 6, 1904 (type collection, W. N. Suksdorf No. 979).

USTILAGO STRIAEFORMIS (Westend.) Niessl. Hedwegia, **15**: 1. 1876.

On *Phleum pratense*, Bingen, Klickitat Co., Wash. May 21, 1896 (W. N. Suksdorf No. 532); Pullman, Whitman Co., Wash. June 21, 1916 (Heald, W. S. C. Path. No. I. S. 285); Oakesdale, Whitman Co., Wash. June 13. 1919 (C. R. Stillinger in Jas. Weir Herb., Spokane, Wash.); Washington State College Campus, east of Silver Lake, Pullman, Whitman Co., Wash. Summer 1919; Waterville, Douglas Co., Wash. June 23, 1919.

On *Poa pratense*, Washington State College Campus, East of Silver Lake, Pullman, Whitman Co., Wash. Summer 1919.

USTILAGO TRITICI (Pers.) Rostr. Overs. K. Danske Vid. Selsk. Forth. **1890**: 15. March, 1890.

On *Triticum* spp., throughout the state of Washington in amounts not exceeding 5 per cent.

USTILAGO URTICULOSA (Nees.) Tul. Ann. Sci. Nat. III., **7**: 102. 1847.

On *Polygonum hydropiperoides*, bottom land of the Columbia River, Bingen, Klickitat Co., Wash. Oct. 7, 1885 (W. N. Suksdorf No. 221).

USTILAGO VIOLACEAE var. *major* Clint. Jour. Myc., **8**: 139. 1902.

On *Silene* sp., Mt. Adams (Mt. Paddo), Wash. Oct. 1, 1904 (W. N. Suksdorf No. 983).

On *Alsine nitans*, Wash. State College Campus, Pullman, Whitman Co., Wash. May 14, 1920.

USTILAGO WASHINGTONIANA El. & Ev. Bull. Torr. Bot. Club, **22**: 57. 1895.

From collection by E. R. Lake, spring of 1892 on leaves of "some grass." The locality is not given in the article. Clinton considers this species as a synonym of *Ustilago striaeformis* (Westend) Niessl.

USTILAGO ZEAE (Beckm.) Unger, Einfl. Bodens 211. 1836.

On *Zea mays*, Walla Walla, Walla Walla Co., Wash. Aug. 16, 1915 (Heald, W. S. C. Path. No. C. S. 201); Sunnyside, Yakima Co., Wash. Oct. 19, 1915 (C. C. Farr, W. S. C. Path. I. S. No. 457); Pullman, Whitman Co, Wash. Aug. 29, 1916 (Heald, W. S. C. Path. No. C. S. 409); Oct. 5,

1916 (Heald, W. S. C. Path. C. S. 435); Pullman, Whitman Co., Wash. Jan. 1, 1918 (E. F. Gaines, W. S. C. Path. No. I. S. 1279); Walla Walla Co. and Yakima Co. Wash. Sept., 1918. Becoming somewhat prevalent in these two localities in the state. Prosser, Benton Co., Wash. July 8, 1919 (E. B. Starkey, W. S. C. Path. I. S. 2032).

UROCYSTIS AGROPYRI (Preuss) Schrot. Abh. Schles. Ges. Abth. Nat. Med., 1869–72: 7. 1870.

On "grass leaves," Bingen, Klickitat Co., Wash. May 3 and 28, 1899 (W. N. Sukslorf No. 464).

On *Bromus marginatus*, Port Townsend, Jefferson Co., Wash. Aug. 7, 1919 (Knight).

On *Elymus condensatus*, Isaacs St., Walla Walla, Walla Walla Co., Wash. June 17, 1919; La Conner Flats, Skagit Co., Wash. June 27, 1919.

UROCYSTIS GEI El. & Ev. Bull. Tor. Bot. Club, **27**: 572. 1900.

On leaves of *Sieversia ciliata* (*Geum ciliata*), Waitsburg, Walla Walla County, Wash. May 7, 1900 (Robert M. Horner No. 1430) Clinton calls this species *Urocystis Waldsteiniae* Peck.

Besides the smuts reported in the preceding list, the following are reported as occurring in Washington. The author, however, has not been able to locate the collections from which these reports were made, viz.:

USTILAGO MACROSPORA Desmaz.

On *Agropyron spicatum inerme* (North Amer. Flora, **7**: 19. 1906).

USTILAGO OLIVACEAE (D. C.) Tul.

On *Carex atriculata* (North Amer. Flora, **7**: 12. 1906).

USTILAGO VINOSA (Berk) Tul.

On *Oxyria digyna* (North Amer. Flora, **7**: 21. 1906).

TILLETIA AIRAE Blytt.

On *Deschampsia caespitosa* (North Amer. Flora, **7**: 49. 1906).

THECAPHORA DEFORMANS Dur. and Mont.

On *Lotus micranthus* (North Amer. Flora, **7**: 41–42. 1906).

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# AN UNDESCRIBED GENEA FROM MICHIGAN[1]

E. A. Bessey and Bertha E. Thompson

(With Plate 20)

The known Tuberaceae from Michigan are few in number. In 1908 Dr. C. H. Kauffman[2] reported *Tuber lyoni* from near Ann Arbor and in 1911[3] he reported from Allegan County a species identified by him as *T. borchii,* and recently described by Miss Gilkey[4] as a new species *T. canaliculatum.* Aside from these there appears to be no published report of the occurrence of fungi of this family in Michigan. In California, on the contrary, twelve genera are recorded and many species, mainly through the work first of H. W. Harkness,[5] and more recently of Miss Gilkey.[6] Whether this great superiority in the number of known species is a true index to the relative frequency of occurrence of these forms in California and elsewhere in the country can be determined only when other botanists make as thorough a search for them as did Harkness, Miss Gilkey, and their collaborators. In California these workers made deliberate search for these forms; elsewhere their discovery has been mainly a matter of chance.

In August, 1919, the senior author found a dozen or more specimens of a hypogaeous fungus at a point in Gogebic County,

[1] Contribution 65 from the Department of Botany, Michigan Agricultural College.

[2] Kauffman, C. H. Unreported Michigan fungi for 1907 with an outline of the Gasteromycetes of the state. Mich. Acad. Sci. Rept., **10**: 63–84. 1908.

[3] Kauffman, C. H. Unreported Michigan fungi for 1910, with outline keys of the common genera of Basidiomycetes and Ascomycetes. *Ibid.*, **13**: 215–249. 1911.

[4] Gilkey, H. M. Two new truffles. Mycologia, **12**: 99–101. *Fig. 1.* 1920.

[5] Harkness, H. W. California hypogaeous fungi. Proc. Calif. Acad. Sci. 3d Ser., **1**: 241–293. 1899.

[6] Gilkey, H. M. A revision of the Tuberales of California. Univ. of Calif. Publications Botany, **6**: 275–356. *pls. 26–30.* 1916.

Michigan, not far from the Wisconsin line. They were found at a depth of three to eight centimeters in the black soil forming the upper ten centimeters or so, of the soil of a forest consisting of sugar maple, hemlock, yellow birch and balsam fir. The soil below this depth consisted of gray sand, moist but not wet. The black upper soil consisted of sand with a large admixture of leaf mold, with numerous needles of balsam fir throughout it, as well as roots and underground stems of various plants such as *Lycopodium lucidulum, Coptis trifolia, Oxalis acetosella, Dryopteris* sp., and *Viola* sp.

The fruiting bodies were found scattered at distances of two to ten centimeters throughout an area of about one square meter, the soil in this region being scantily filled with a loose gray mycelium which did not show on the surface of the soil and was not noticeably more abundant near the fruiting bodies.

The single, somewhat lobed cavity and distinct central opening and the slender paraphyses extending beyond the cylindrical eight-spored asci determine the fungus as belonging to the genus *Genea*. From *Hydnocystis* it differs in the somewhat lobed cavity and secondary cortex formed by the paraphyses projecting beyond the asci.

From the described species of *Genea* this fungus differs in its spore characters. Ordinarily the spores are spherical or slightly ellipsoidal and marked by papillae or warts; in these Michigan specimens the spore have no signs of warts or papillae but are smooth, except that the epispore may show some irregular folds. The spores, moreover, are not spherical or ellipsoidal, but in side view appear square or rectangular, except the apical spores which may be irregularly rounded. Through mutual pressure of the asci and paraphyses the former and their enclosed ascospores are more or less polygonal in cross section and in some cases almost square. In the latter case the central ascospores are actually cubical as they always appear to be when viewed from the side.

The hyaline spores when mature possess a spherical or slightly ellipsoidal hyaline endospore surrounded by a hyaline exospore that is often only very slightly developed laterally, but very much

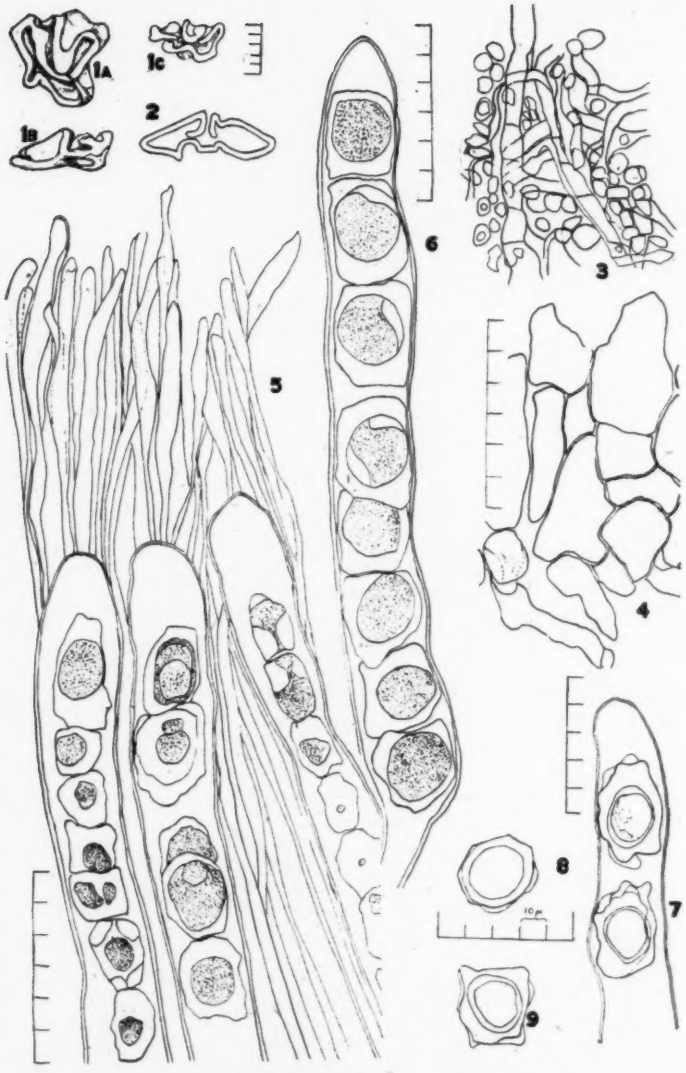
thickened at the end of the spores; particularly of those spores at or near the apex of the ascus. This exospore is externally thrown into folds but never into warts, prickles or tubercles.

**Genea cubispora** sp. nov.

Ascocarp when dry 7 to 9 mm. in diameter and 5 to 8 mm. in vertical thickness, slightly larger when fresh, with somewhat cerebriform external folds and involutions which have a tendency to radiate from the central opening. When fresh the whole surface was isabelline in color, but when dry and after handling the exposed convex edges of the folds are castaneous. Surface mealy and very slightly pubescent, surrounding mycelium scanty. Cavity single, but thrown into irregular pockets by the folds and involutions of the surface. Opening central, 1 to 2 mm. wide, the edge turned in nearly to the base of the cavity. Ascocarp wall 700 to 800 $\mu$ thick, the outer 100 to 150 $\mu$ consisting of large pseudoparenchymatous cells, the next 100 to 150 $\mu$ of tangled, frequently septate hyphae 5 to 10 $\mu$ in diameter, the remaining 500 to 600 $\mu$ consisting of the hymenium. Hymenium continuous, not areolate; asci cylindric, 300–350 $\times$ 25–30 $\mu$, rounded at the apex and tapering abruptly at the base. Paraphyses filiform, occasionally, but indistinctly, septate, overtopping the asci 75 to 110 $\mu$ and forming a secondary cortex. Ascospores eight, monostichous, the basal and central ones almost isodiametric, 27–28 $\times$ 24–28 $\mu$, the one or two nearest the apex often longer, 36–42 $\times$ 24–28 $\mu$. Lumen of spores 14–18 $\mu$ wide and 16–22 $\mu$ long; the endospore 1.2–3 $\mu$ thick. Epispore laterally 0.2–4 $\mu$ in thickness and 2–4 $\mu$ thick on the ends of all the spores except those at or next to the apex where the thickness reaches 5–10 $\mu$. Epispore thrown into irregular folds but without papillae, tubercles or reticulations. Ascospores polygonal in cross section, occasionally even square.

In black leaf-mold 3 to 8 cm. below the surface in forest consisting of dense growth of *Acer saccharum, Tsuga canadensis, Betula lutea* with considerable *Abies balsamea*. Between Bass and Little Bass Lakes of the Cisco Lake chain, Gogebic County, Michigan, August 14, 1919. No. 123 Bessey and Darlington.

MICHIGAN AGRICULTURAL COLLEGE,
EAST LANSING, MICHIGAN.




GENEA CUBISPORA BESSEY & THOMPSON

EXPLANATION OF PLATE 20

Fig. 1*a*. Top view, 1*b*, edge view of same ascocarp, and 1*c*, top view of another ascocarp. Natural size.

Fig. 2. Vertical section through ascocarp. Natural size.

Fig. 3. Tissues from middle of wall of ascocarp.

Fig. 4. Tissues from exterior of wall of ascocarp.

Fig. 5. Upper portion of hymenium showing paraphyses extending beyond the asci in a sort of secondary cortex. Ascospores and asci not quite mature.

Fig. 6. An ascus with ascospores not quite mature.

Fig. 7. Apex of ascus showing two mature ascospores.

Fig. 8. Ascospore in cross section.

Fig. 9. Lateral view of a middle or basal ascospore.

NOTE: The small divisions of the scales accompanying the figures represent millimeters for Figures 1 and 2, and 10 $\mu$ in all the remaining drawings. Figures 3 and 4 are drawn to the same scale.

## NOTES AND BRIEF ARTICLES

*[Unsigned notes are by the editor]*

Readers of MYCOLOGIA are invited to contribute to this department personal news items and notes or brief articles of interest to mycologists in general. Manuscript should be submitted before the middle of the month preceding the month in which this publication is issued.

It is said that eating the common ink-cap mushroom, *Coprinus atramentarius,* sometimes causes reddening of the face. Anyone who can corroborate this statement from his own experience or observation should publish the fact.

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Dr. E. W. Olive, who has been connected with the Brooklyn Botanic Garden for several years, has retired from active scientific work to go into business with his brother at 904 Hume-Mansur Building, Indianapolis, Indiana.

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A circle of fairy-ring mushrooms thirty feet in diameter was seen at Kingston, New York, July 10, in the yard of the famous old Dutch Reform Church. The mushrooms grew about the roots of trees, in the grass, and over graves with stones dating back as far as 1798.

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The use of aged bean seed as a means of controlling bacterial blight of beans is advocated by C. W. Rapp in *Science,* p. 568, 1919. Seed four or five years old does not germinate well, but three-year-old seed yields a high percentage of vigorous plants with very little blight if the soil is free from the disease and no sources of infection are near.

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Referring to the article entitled "Another New Truffle," published in the May number of *Mycologia,* Dr. C. L. Shear writes me as follows: "In order to make this story complete, I think it would be desirable to add a note referring to the fact that this

particular collection was mentioned by me in the *Asa Gray Bulletin* for December, 1899, under the heading 'A Truffle from Maryland.' If this connection is not pointed out it may not be known and confusion may arise. The specimens referred to in the note as *T. oligosperma* Tul. are the identical specimens which are described as the new species of *Tuber* in your article."

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Excellent specimens of *Xanthoporia Andersoni* (Ellis & Ev.) Murrill were recently sent to the herbarium of the Garden for determination. They were collected on *Salix nigra* in Takoma Park, Maryland, May 5, 1920, by Hedgcock, Hahn, and Gravatt. This interesting species was first described from Newfield, New Jersey, where it was found by F. W. Anderson on an oak log. It has since been collected on poplar in Indiana, on oak in Missouri, and on elm or poplar in Ohio. The specimens recently received add a new host and a new state to its distribution.

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Burt's eleventh paper on the Thelephoraceae of North America, published in the *Annals of the Missouri Botanical Garden* for November, 1919, includes *Tulasnella,* with 3 species; *Veluticeps,* with 1 species; *Mycobonia,* with 2 species; *Epithele,* with 2 species; and *Lachnocladium,* with 10 species from North Amercia. The following are new or newly combined: *Veluticeps tabacina* (Cooke) Burt, comb. nov.; *Epithele sulphurea* Burt, sp. nov., on palmetto in Florida; *Lachnocladium bicolor* (Peck) Burt, comb. nov.; and *L. erectum* Burt, sp. nov., on dead wood in West Virginia. The members of this genus are coralloid fungi usually occurring on wood or soil rich in humus. They resemble species of *Clavaria,* but are tomentose and leathery rather than fleshy, and therefore inedible. The spores vary from hyaline to ochraceous and from smooth to aculeate. *Lachnocladium Micheneri* Berk & Curt. is our commonest temperate species, ranging from Canada to New Jersey and westward to Missouri.

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According to Paravicini, since the cultivation of the "English" walnut has been greatly extended in Switzerland the importance

of the larger fungi which attack this valuable tree has correspondingly increased. *Polyporus igniarius, P: fomentarius, P. hispidus, P. cinnabarinus, P. sulphureus,* and certain other fungi are mentioned among the enemies of the walnut, but, strange to say, *Favolus europaeus* is considered the most virulent of them all. It gains entrance through wounds in the branches. The only known method of treatment is to remove all diseased branches and cover the cut surfaces with grafting wax. This species is known to be fond of our native hickory trees and should be further investigated.

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Burt's paper on *Aleurodiscus* in the *Annals of the Missouri Botanical Garden* for September, 1918, includes 14 North American species, all of which are illustrated by text-figures showing microscopic characters. According to the author, 25 species have been recognized for the genus: 8 in Europe, 5 in Asia and Australia, 2 in Africa, and 2 in South America. Most of our species are of local distribution. They are as follows: *Aleurodiscus amorphus* (Pers.) Rabenh.; *A. Farlowii* Burt sp. nov., on dead hemlock twigs in New Hampshire and New York; *A. Oakesii* (Berk. & Curt.) Cooke; *A. apiculatus* Burt sp. nov., on fallen dead wood in Jamaica, Porto Rico, and Grenada; *A. candidus* (Schw.) Burt comb. nov.; *A. strumosus* (Fries) Burt comb. nov.; *A. seriatus* (Berk. & Curt.) Burt comb. nov.; *A. nivosus* (Berk. & Curt.) v. Höhn. & Litsch.; *A. acerinus* (Pers.) v. Höhn. & Litsch.; *A. botryosus* Burt sp. nov., on dead stems of *Rubus* and *Vitis* in Massachusetts, Maryland, and Mexico; *A. cremeus* Burt sp. nov., on dead oak wood in New Mexico; *A. tenuis* Burt sp. nov., on dead twigs in Cuba; *A. penicillatus* Burt sp. nov., on dead wood of *Pseudotsuga* and *Tsuga* in Idaho, Washington, and Oregon; and *A. Weirii* Burt sp. nov., on decaying wood of *Abies, Thuja,* and *Larix* in Idaho and British Columbia.

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The North American species of the genus *Hymenochaete* are treated by Burt in the *Annals of the Missouri Botanical Garden* for November, 1918; the majority of the 37 species included

being illustrated by halftones of the hymenophores and figures in the text showing the character of the setae. According to the author, in the simplest condition of the fructification in this genus, only a setigerous layer is present; in the next degree higher of development, a hyphal layer connects the setigerous layer with the substratum or may be extended from the substratum as the upper surface of the pileus; while in a still more highly developed condition, the hyphal layer, is differentiated into an intermediate layer and a denser and dark zone, and usually into a second hyphal layer adnate to the substratum or forming the surface of the pileus. In addition to the distinctive morphological character of elongated, conical setae in the hymenium, there is also a chemical substance in the tissue of all the species of *Hymenochaete* studied, that causes an immediate darkening of sections when dilute potassium hydrate is brought in contact with them. *Hymenochaete* is a genus of tropical species rather than of the cooler portion of the north temperate zone; for, in contrast with the 29 species occurring from the Gulf States to Brazil, only 13 species are known north of the latitude of Virginia, and from Europe perhaps 9 species, of which 6 are well known.

The following species are described as new: *H. borealis* Burt sp. nov., on dead frondose wood from Ontario to New Jersey; *H. reflexa* Burt sp. nov., on dead wood in Jamaica; *H. cubensis* Burt sp. nov., on dead wood in Cuba and Porto Rico; *H. ungulata* Burt sp. nov., on dead wood in Mexico; *H. digitata* Burt sp. nov., on dead logs in Panama; *H. fulva* Burt sp. nov., on fallen branches in Louisiana and Jamaica; *H. pinnatifida* Burt sp. nov., on fallen branches from Georgia to Louisiana and in Mexico, Cuba, and Jamaica; *H. multisetae* Burt sp. nov., on fallen branches in Cuba and Jamaica; *H. anomala* Burt sp. nov., on fallen branches in Cuba; and *H. opaca* Burt sp. nov., on dead branches in Jamaica.

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### ONYGENA EQUINA (WILLD.) PERS.

On May 1, 1920, I collected excellent specimens of *Onygena equina* (Willd.) Pers. on cow's horns and on part of a cow's hoof

in Morgan's woods, north of Macdonald College, Quebec, Canada. So far as I can ascertain the horns and hoofs had been lying in the woods for some five years, the cattle having been killed and buried there as being tubercular.

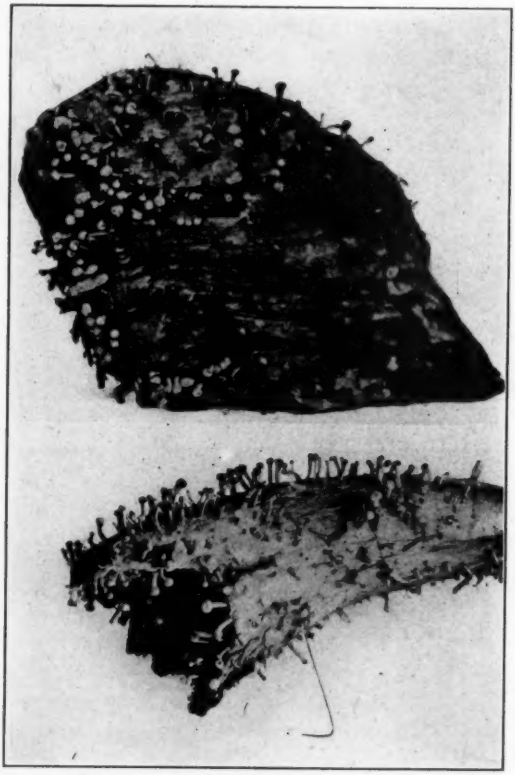

Fig. 1. The upper specimen shows fructifications on a cow's hoof. The variation in the size of sporocarps is noticeable, and the uppermost and lowest show the gleba exposed by dehiscence of the peridium. In the lower specimen figured, some sporocarps are seen to have developed from the inner surface of the horn.

The development of sporocarps was so good that photographic records were made. In each photograph variations in the size

of head and length of stipe are easily seen. The dehiscence of the peridium is plain and the exposed mass of spores and capillitium appears dark in the photographs as in nature.

Marshall Ward gives a very complete description of the fungus and of his cultural experiments with it in Vol. 191 B of the Philosophical Transactions of the Royal Society of London for 1899. A brief description of the fungus may not be out of place:

Fructification rounded, stalked or sessile, 1 to 5 mm. in height; peridium whitish, dehiscing irregularly or in lobes; asci globoid, 8-spored, 10 to 14 $\mu$ by 14 to 22 $\mu$; ascospores yellowish to hyaline, 4 to 5 $\mu$ by 7 to 9 $\mu$.

The asci are very difficult to obtain in good condition when dissecting sporocarps which are mature or nearly so since they readily rupture and collapse after the dispersal of the ascospores.

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## A NEW AMANITA

This species is dedicated to the discoverer, Professor H. L. Wells, of the Sheffield Scientific School of Yale University, who has carefully studied it for several years. The accompanying description is drawn up from his ample field notes and photographs. Limited space forbids further discussion of this beautiful species here, but a more extended treatment will be prepared by Dr. Kelly and Mr. Krieger from notes and illustrations which I shall furnish them.

**Venenarius Wellsii** sp. nov.

Pileus globose to convex, at length expanded, becoming nearly plane, gregarious, 5 to 10 cm. broad when expanded; surface dry, salmon-colored, fading, especially after a rain, usually remaining more deeply colored on the disk, covered with exceedingly minute, yellowish-buff warts, mostly distributed irregularly in large patches; margin of young plant usually showing a very delicate, bright-yellow tomentum, not striate at first, but becoming distinctly so and showing the gills about halfway to the center, extending beyond the gills about 2 to 3 mm. forming a conspicuous sterile edge, colored like the pileus when viewed from below:

context easily separable from the cuticle, bright-yellow, becoming buff with age, at first mild to the taste, but with a lingering unpleasantness; lamellae free or adnexed, about 1 cm. wide to narrower at the stipe, moderately crowded, pale-dull-yellow, edges at first distinctly furfuraceous; spores ellipsoid, smooth, rounded at the ends, obliquely apiculate at the base, hyaline, uni-guttulate, $12 \times 7 \mu$; stipe tapering upward, bulbous at the base, stuffed or hollow, clothed with a very delicate, furfuraceous layer above the annulus, nearly glabrous below, pale-dull-yellow, 7 to 12 cm. long; annulus distinctly yellow, very delicate and loosely woven, thin, usually adhering to the margin of the cup in an appendiculate way after rupture, and leaving but a slight, delicate ring on the stipe; volva very delicate and loosely woven, distinctly yellow, sometimes pointed, but more often nearly flat at the base, soon glabrous, becoming less distinct with the growth of the plant.

Type collected in the township of Springfield, New Hampshire, about September 1, 1917. Known from several other localities in New Hampshire, also.

For the benefit of those following Saccardo, I add the combination **Amanita Wellsii.**

W. A. MURRILL.

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## CULTURES OF PUCCINIA CLEMATIDES (DC.) LAGERH. AND PUCCINIA IMPATIENTIS (SCHW.) ARTH.

During 1917 and 1918 the baneberries, *Actaea alba* (L.) Mill. and *A. rubra* (Ait.) Wild., which grew in a small wood near Ste. Anne de Bellevue, P. Q., were heavily infected with aecia. Field evidence suggested the connection of these aecia with *Puccinia Clematidis* (DC.) Lagerh. on *Hystrix patula* Moench. Roots of *Actaea rubra* were dug up in the fall and kept in a cool cellar during the winter. When placed in a greenhouse in the spring, they developed rapidly. Wintered telial material of *Puccinia Clematidis* on *Hystrix patula* was tested and found visible. Inoculations were made on three pots of *Actaea rubra* on April 28th. Aecia were first noticed on May 5 and a very heavy infection developed. One pot of plants kept as a check remained free from infection. The inoculations and observations connected with these cultures were made by Mr. P. I. Bryce, of the Biology Department of Macdonald College, who also made the

collections and field observations on *Actaea* that suggested them.

The aecia on the infected plants, especially on the stems, produced abundant ascospores for some time. A number of grasses grown from seed in the greenhouse were inoculated with aeciospores from these cultures and also from aecia collected in the field on *Actaea rubra* at Ste. Anne de Bellevue. These inoculations and the observations in connection with them were made by Miss Margaret Newton, a graduate student of Macdonald College. The results are given in tabular form below.

| Grass Inoculated | Source of Material | Date of Inoculation | Date of Uredinia | Nature of Infection |
|---|---|---|---|---|
| *Elymus canadensis* L. | Aecispores from culture on *Actaea* | June 13 | June 22 | Very heavy infection |
| *Elymus virginicus* L. | " " " | " " | " 23 | " " " |
| *Hordeum jubatum* L. | " " " | " " | " " | Slight infection |
| *Hystrix patula* Moench. | " " " | " " | " " | Very heavy infection |
| *Agropyron repens* (L.) Beauv. | " " " | " " | " " | No infection |
| *Agropyron Richardsonii* Schrad. | " " " | " " | " " | Very heavy infection |
| *Bromus ciliatus* L. | " " " | July 12 | —— | No infection |
| *Elymus virginicus* L. | " " " | " " | July 21 | Very heavy infection |
| *Agropyron Richardsonii* | " " " | " " | Telia Aug. 13 —— | No infection |
| *Hystrix patula* | " " " | " " | No record | Very heavy infection |
| " " | Aeciospores from field collection on *Actaea* | " 10 | July 20 | " " " |
| *Elymus canadensis* | " " | " " | Telia Aug. 13 | " " " |
| " *virginicus* | " " | " " | July 19 | " " " |

The material from the cultures was studied by Dr. E. B. Mains with the aid of Dr. Arthur's herbarium. He found that the aecial and telial material corresponded to the herbarium material of the European *Puccinia Actaeae-Elymi* Mayor and *P. Actaeae-Agropyri* Ed. Fisch. The urediniospores were somewhat smaller than is usual in *Puccinia Clematidis*. It seemed as if all these should be considered as belonging to one species, but probably representing several races for whose delimitation further culture work is necessary. They all belong in the species *Puccinia Clematidis* (DC.) Lagerh. as it has been considered by Arthur in North America.

These experiments and studies seem to establish the connec-

tion of the aecia on *Actaea rubra* (Ait.) Wild. with *Puccinia Clematidis* (DC.) Lagerh on *Hystrix patula* Moench. and also show that *Elymus canadensis* L. and *E. virginicus* L. are congenial hosts.

Further experiments were made at Saskatoon, conducted by Miss Hulda Haining, with aecia collected at Brandon, Man., on *Thalictrum dasycarpum* Fischer & Lall. Inoculations were made on the following grasses grown from seed in the greenhouse: *Bromus ciliatus* L., *B. latiglumis* (Shear) Hitchk., *Elymus canadensis* L., *E. virginicus* L., *Agropyron repens* (L.) Beuv., *A. Smithii* Rydb., *A. tenerum* Vasey, *A. Richardsonii* (Trin.) Schrad, and *Hordeum jubatum*. L. *Bromus ciliatus* and *latiglumis* were heavily infected and uredinia and telia developed abundantly. *Elymus canadensis* and *E. virginicus* were also heavily infected, but the others showed no infection. On *Bromus* the teliospores were of the many-celled type, on *Elymus* they were of the ordinary two-celled kind. It seems probable that the plants of *Thalictrum* used in the cultures contained a mixture of aecia of two races, one infecting *Bromus* and producing multicellular teliospores, and the other *Elymus* with the two-celled type of teliospores, as was indicated by the experiments in 1918. (See under *Puccinia Agropyri* E. & E. Mycologia **11**: 131. 1919.)

PUCCINIA IMPATIENTIS (Schw.) Arth.

Inoculations were made in the greenhouse at Saskatoon with aeciospores from aecia collected at Dauphin, Man., on *Impatiens biflora* Walt. on the following grasses grown from seed in the greenhouse: *Agropyron Smithii, A. tenerum, A. Richardsonii, Hordeum jubatum, Elymus canadensis, E. virginicus,* and *Triticum vulgare*. There was a slight infection of *A. tenerum, A. Richardsonii,* and *Hystrix patula* and rather heavy infection of *Elymus canadensis* and *E. virginicus* and heavy infection of *Hordeum jubatum*. Three inoculations were made on *Hordeum jubatum* and heavy infection resulted in each case. (See Mycologia **11**: 131. 1919.)

Inoculations were also carried out at Macdonald College by Miss Margaret Newton with aecia on *Impatiens biflora* Walt. collected at Hudson, P. Q., on the following grasses grown from

seed in the greenhouse: *Hordeum jubatum, Elymus canadensis, E. virginicus,* and *Hystrix patula.* Both species of *Elymus* were very heavily infected and *Hordeum* was slightly infected. Another inoculation was made on *Hordeum jubatum* and slight infection followed. As the plants of *Hordeum jubatum* used in these experiments were not in a healthy condition little value can be placed on the results which tend to show that *Hordeum jubatum* is not a congenial host in Eastern Canada. Arthur has shown by several cultures that the aecia on *Impatiens* are connected with *Puccinia Impatientis* on *Elymus.*

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# INDEX TO AMERICAN MYCOLOGICAL LITERATURE

**Adams, J. F.** The alternate stage of *Puccinastrum Hydrangeae*. Mycologia **12**: 33–35. 1920.

*Peridermium Hydrangeae* (Berk. & Curt.) comb. nov.

**Appel, Otto, & Westerdijk, Johanna.** Die Gruppierung der durch pilze bervorgerufenen pflanzenkrankheiten. Zeits. Pflanzenkrank. **29**: 176–186. 1919.

**Arthur, J. C.** Two destructive rusts ready to invade the United States. Science **61**: 246, 247. 5 Mr 1920.

**Bisby, G. R.** Short cycle *Uromyces* of North America. Bot Gaz. **69**: 193–217. *pl. 10.* 16 Mr 1920.

**Brown, N. A., & Harvey, R. B.** Heart-rot, rib-rot, and leaf-spot of Chinese cabbages. Phytopath. **10**: 81–90. *f. 1–4.* 1920.

**Burt, E. A.** The Thelephoraceae of North America XI. Ann. Mo. Bot. Gard. **6**: 253–280. *f. 1–15. pl. 5.* 2 Mr 1920.

*Epithele sulphurea* and *Lachnocladium erectum* sp. nov.

**Clinton, G. P.** Infection experiments of *Pinus Strobus* with *Cronartium ribicola*. Bull. Conn. Agr. Exper. Sta. **214**: 428–459. *pl. 37–44.* S 1919.

**Clinton, G. P.** Inspection of phaenogamic herbaria for rusts on *Ribes* spp. Bull. Conn. Agr. Exper. Sta. **214**: 423-427. S 1919.

**Detwiler, S. B.** Results of white pine blister-rust control in 1919. Phytopath. **100**: 177–180. 1920.

**Ehrhorn, E. M.** New pests on the mainland. Hawaiian Forest. & Agr. **17**: 35, 36. F 1920.

**Elliott, J. A.** Arkansas peach diseases. Bull. Univ. Ark. Agr. Exper. Sta. **149**: 1–9. *pl. 1–5.* Jl 1918.

**Erz, A. A.** The true nature of plant diseases. Am. Bot. **26**: 20–23. 20 F 1920.

**Fracker, S. B.** Varietal susceptibility to false blossom in cranberries. Phytopath. **10**: 173–175. 1920.

**Hartley, Carl, and Hahn, G. G.** Notes on some diseases of aspen. Phytopath. **10**: 141–147. *f. 3.* 1920.

**Herre, A. C.** Notes on Mexican lichens. Bryologist, **23**: 3, 4. 1920.

**Lloyd, C. G.** Mycological notes. **61**: 877–903. *pl. 124–139.* O 1919.

**Matsumoto, Takashi.** Culture experiments with *Melampsora* in Japan. Ann. Mo. Bot. Gard. **6**: 309–316. *f. 1–3.* 1920.

**McCulloch, Lucia.** Basal glume-rot of wheat. Jour. Agr. Research **18**: 543–551. *pl. 62, 63.* 16 F 1920.

**Melchers, Leo E., & Parker, J. H.** Three winter-wheat varieties resistant to leaf-rust in Kansas. Phytopath. **10**: 164–171. *f. 1–3.* 1920.

**Murrill, W. A.** The artist's bracket fungus. Sci. Am. **122**: 365. 1920.

**Neal, D. C.** Phony peaches; a disease occurring in middle Georgia. Phytopath. **10**: 106–109. *pl. 9. f. 1.* 1920.

**Peltier, G. S.** Snapdragon rust. Bull. Univ. Ill. Ag. Exper. Sta. **221**: 535–548. *f. 1–5.* Au 1919.

**Rosen, H. R.** A bacterial root-rot of field corn. Bull. Univ. Ark. Exper. Sta. **162**: 1–6. *pl. 1–4.* Au 1919.

**Rosenbaum, J.** Infection experiments on tomatoes with *Phytophthora terrestria* Sherb, and a hot water treatment of the fruit. Phytopath. **10**: 101–105. 1920.

**Rosenbaum, J., & Sando, C. E.** Correlation between size of the fruit and the resistance of the tomato skin to puncture and its relation to infection with *Macrosporium tomato* Cooke. Am. Jour. Bot. **7**: 78–82. 1920.

**Stevens, F. L.** Dothidiaceous and other Porto Rican fungi. Bot. Gaz. **69**: 248–257. *pl. 13, 14. f. 1–3.* 16 Mr 1920.

1 new genus, 15 new species.

**Stevenson, J. A.** The mottling or yellow-stripe disease of sugar cane. Jour. Dept. Agr. Porto Rico **3**: 3–76. Jl 1919.

**Thomas, Roy C.** A new lettuce disease. Ohio Agr. Exper. Sta. **5**: 24, 25. Ja 1920.

**Tisdale, W. B.** Iris leaf-spot caused by *Didymellina iridis.* Phytopath. **10**: 148–163. *f. 1–6.* 1920.

**Vasey, H. E.** Millet smuts and their control. Col. Agr. Exper. Sta. **242**: 3–22. *f. 1–11.* F 1918.

**Walker, J. C., & Tisdale, W. B.** Observations on seed transmission of the cabbage black-rot organism. Phytopath. **10**: 175–177. 1920.

**Weimer, J. L.** Some observations on the spore discharge of *Pleurage curvicolla* (Wint.) Kuntze. Am. Jour. Bot. **7**: 75–77. 1920.

**Weimer, J. L.** The distribution of buckeye rot of tomatoes. Phytopath. **10**: 172. 1920.

**Wolf, F. A.** A bacterial leaf-spot of velvet bean. Phytopath. **10**: 73–80. *f. 1, 2.* 1920.

*Aplanobacter stizolobii* sp. nov.

**Wolf, F. A.** Bacterial blight of soybean. Phytopath. **10**: 119–132. *f. 1–5.* 1920.

**York, H. H.** Late seasonal production of aecia of *Cronartium ribicola.* Phytopath. **10**: 111. 1920.